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WATERSHED CHARACTERISTICS AND CONDITIONS INVENTORY

UPPER MASHEL RIVER WATERSHED
CHARLEY CREEK WATERSHED

By

Jones and Stokes Associates

March 1991

Watershed Characteristics and Conditions Inventory

Upper Mashel River Watershed
Charley Creek Watershed

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Group B: West Slope Cascade Mountians

INTRODUCTION

The Timber/Fish/Wildlife (TFW) program is based on an agreement between representatives of Indian tribes, state agencies, the timber industry, and environmental groups within the state of Washington" As part of the TFW agreement, a series of ground rules were adopted to form the basis of a new natural resources management system. Cooperative research, monitoring and evaluation are key to this "adaptive management" system to provide information on which to base future management decisions.

The Ambient Monitoring Steering Committee (AMSC) of the TFW Cooperative Monitoring, Evaluation and Research Committee (CMER) has contracted with Jones & Stokes Associates to conduct a Watershed Characteristics and Conditions Inventory (WCCI) on six watersheds within the state. The goal of the project is to provide information necessary to interpret the influence of watershed conditions on the characteristics of stream channels. This WCCI has involved the collection and compilation of information related to the natural characteristics and management-affected conditions of the designated watersheds. Stream surveys have previously been completed by AMSC trained crews on all or portions of the streams within these watersheds.

The six watersheds have been divided into three groups: West Slope Cascade Mountains, Olympic Peninsula, and East Slope Cascade Mountains. This report presents the results of the WCCI for the West Slope Cascade Mountains group, consisting of the Upper Mashel River and Charley Creek watershed.

Part 1 of this report describes the methods of data collection and results of the inventory for the upper Mashel watershed; Part 2 presents this information for Charley Creek. Part 3 consists of a comparative summary and conclusions regarding the inherent stability and harvest intensity within the study areas. A series of 1:24,000-scale maps and overlays, with attributes described on Dbase data files, accompanies this report.

PART 1. UPPER MASHEL RIVER WATERSHED

The Mashel River is located approximately 12 miles west of Mt. Rainier in the Nisqually River watershed. The WCCI was conducted on that portion of the watershed above the junction with Busy Wild Creek. The 18.5-square mile watershed lies within Sections 2-4 of Township 15 N, Range 6 E; Sections 12, 13, 24 and 25 of Township 16 N, Range 5 E; and sections 5-9, 16-23, and 26-35 of Township 16 N, Range 6 E.

Methods

Watershed Characteristics

Climate

Elevation. The upper Mashel River watershed boundary was delineated on the LeDout Creek and Ashford USGS 7 1/2 minute topographic maps Basin relief was calculated by determining the difference in elevation between the basin mouth and the highest point on the watershed divide. Mean elevation was determined by measuring the area of the entire watershed, then measuring the area above mid-basin contours. The mean elevation is the contour elevation above which 50% of the watershed area is located.

Precipitation. Precipitation information was obtained from USGS Climate-data disks. The disks were searched to locate weather stations within 20 miles of the upper Mashel River and within the elevational. range of the watershed. Two stations met the criteria: Electron Headworks at 1,730 feet and Rainier Longmire at 2,760 feet. A summary of average monthly and annual precipitation and snowfall for these stations is included in Appendix A.

Average monthly precipitation and snowfall data from the two stations was weighted on an area basis to determine monthly precipitation for the upper Mashel River watershed. The area weighting was accomplished by drawing lines along the contour elevations halfway between the elevations represented by each station. Each station was assumed to represent the watershed area within these lines. A weighting factor was then assigned based on the percent of the watershed area represented by each station.

The 2-year, 24-hour precipitation event for the watershed 'was determined by consulting the NOAA Precipitation Frequency Atlas (1970). Due to the large scale (l-inch = 20 miles) of the NOAA map, the entire basin was represented by two isopluvials. The 2-year, 24-hour precipitation for the basin is the area-weighted average of the two isopluvials crossing near the mouth and headwaters.

Air Temperature. Air temperature information was obtained from the USGS Climatedata disk. Because ciaily temperature values were not available, average monthly values were used. Average monthly maximum and minimum temperatures for Electron Headworks and Rainier Longmire were weighted on an area basis in the same manner as the precipitation data to determine temperatures for the upper Mashel River watershed. A. summary of temperature information for the two stations is included in Appendix A.

Water Temperature. Although water temperature data is available for the Mashel River, readings were taken at the USGS gaging station, approximately 15 miles downstream of the study basin. Because of the distance from the study basin, and the high variability in climate as well as canopy cover throughout the watershed, the stream temperature data for the mouth was not extrapolated to the upper Mashel River sub-basin.

Geology. The Geologic Map of Washington - Southwest Quad (Walsh et al. 1987 - original scale 1:250,000) was reproduced at a scale of 1:24,000 to construct the Geology Overlay of the watershed. The mapping unit boundaries displayed on the Geology Overlay should be viewed with the original scale of this map in mind. The Geology Overlay merely provides a general characterization of the underlying geology of the watershed, as opposed to a detailed geologic investigation.

Soils. The Soils Overlay was constructed using the State Soil Survey Township Soils Maps (original scale 1:24,000) for the South Puget Area (WDNR, 1974). Information from the State Soil Survey Report for the South Puget Area was then incorporated into a database. The database includes acreage of each mapping unit, soil name, natural and disturbed stability ratings, road-related erosion hazard, timber harvest-related erosion hazard, and site index. These parameters are explained in the database description included in Appendix C.

Hydrology

Drainage Network and Basin Dimensions. Stream orders were completed for the watershed using the standard method developed by Strahler (1964). Unbranched, blue-line tributaries are designated as first-order streams on the 1:24,000 scale USGS topographic base maps. Second-order streams are designated where two first-order streams flow together, and third-order streams are designated when two second-order streams join. Drainage density was computed by measuring the total length of streams in each order and dividing by the watershed area.

Watershed area was measured with a Planix planimeter. The fourth-order watershed was divided into two third-order subbasins. Basin length was measured from the mouth to the drainage divide following the main channel. Basin width was measured at the midpoint of the channel, perpendicular to the direction of flow. Relief ratio was calculated as basin relief divided by the length of the basin (Dunne and Leopold, 1974).

Flow. A USGS gage is located near La Grande, Washington, at the mouth of the Mashel River. Seventeen years (1941-1957) of daily streamflow data at this gage was obtained from ‘USGS Hydrodata disks. A summary of the gaging data and daily flow values are included in Appendix A.

A daily hydrograph for the upper Mashel River was constructed by weighing the daily flow values of the entire watershed by the fraction of the watershed represented by the upper Mashel. This method of applying a basin area factor was recommended by Rick Dinicola, surface water hydrologist for the USGS. (He advised against using a precipitation weighing factor based on elevation, because without an immense modelling effort this method would lead to erroneous results [Rick Dinicola, pers. comm.]).

A flow duration curve was calculated by hierarchically analyzing the area-weighted daily values (from lowest to highest), to determine the percent of time each flow value was equalled or exceeded.

The average annual flow value was obtained by area-weighting the average annual flow value obtained from the USGS gaging station near La Grande. The 2-year return period flow was calculated using Weibull's formula (in Linsley et al. 1975), which relates return period to the rank of the event in order of magnitude and the number of years of record.

Existing Studies. Local land managers and the Nisqually Indian Tribe were contacted to determine whether any instream flow or other pertinent studies have been conducted on the Upper Mashel River.

Geomorphology

Slope Classes. The watershed was stratified into slope classes based on the spacing of contour lines on 7 1/2 minute USGS maps. Slope classes were: 0% to 5%; 5% to 30%; 30% to 65%; 65% to 90% and greater than 90%. A key was developed which depicted the 40-foot contour interval for 5%, 30%, 65%, and 90% slopes. The Slope Class Overlay was manually constructed by moving the key around on the map to visually identify areas in each slope class. The minimum size of the delineated areas is 5 acres.

Channel Profile. A channel profile of the mainstem was constructed by measuring the length of the channel between each 40-foot contour line on the USGS 7½ minute topographic map. Channel slope was then calculated by dividing the rise in elevation by the channel distance. Channel slope was calculated for each valley segment type, as described in the following section.

Valley Segments. Valley segments were identified using the methodology developed by Cupp (1989). Initial segmentation was done using a topographic map, the Slope Class Overlay and channel profile, and aerial photos. The Slope Overlay was a useful tool in determining sideslope gradient for the initial level of valley segment stratification. Final segment breaks were verified during the November 8, 1990 field review.

Watershed Conditions

Vegetation

Dominant Species and Timber Harvest Intensity. Major landowners within the Upper Mashel River watershed were contacted to obtain timber stand species composition, age, and stand density. Champion International Corporation and Weyerhauser Company supplied detailed timber stand maps and inventory data. Original scale of the timber stand maps was 1:12,000.

Vegetation information for a small area of the watershed owned by Plum Creek Timber Company was interpreted from 1985 1:12,000 scale aerial photos. Stand composition, age, and density were determined by comparing these stands to adjacent stands for which information had been supplied by the landowner.

Stand maps supplied by the landowners were redrafted onto mylar overlays. Some difficulty was encountered in precisely matching section lines on the maps supplied by the landowners with those on the USGS quadrangles. Accuracy of the stand lines is estimated to be within 40 feet horizontal distance of actual stand boundaries.

Tree density of younger stands on Champion International land was estimated. The inventory for these young stands employed a four category rating based on the percentage of plots with adequate stocking, rather than actual trees per acre. Beals (pers. comm.) supplied estimated trees per acre figures which related to the stocking codes. Stands for which trees per acre were estimated are considered within 50 trees per acre of actual stand density. The database distinguishes these stands by the notation "tpa is estimate".

The Vegetation Overlays consist of a series of numbered cells which are keyed to a Dbase database that contains information on cell acreage, dominant and subdominant species, year of origin, and trees per acre. Year of origin, rather than stand age, was entered into the database in order to avoid the need to cross-reference to the year of inventory. Also included in the database is locational information, including water resource inventory area (WRIA), subwatershed, legal description, ownership, and the original identification number assigned by the landowner. The comments section in the database identifies stands for which vegetation information was interpreted from aerial photos, or stand density was estimated, as described above.

Aerial photos and a November 8 field review verified the vegetation data. Particular attention was given to ensuring that recent harvest activities were accurately portrayed.

Riparian Condition. The condition of riparian vegetation. along the mainstem of the upper Mashel River was given special scrutiny during this inventory. Riparian vegetation species and age were determined from the junction witb Busy Wild Creek upstream to Lake Mary Lea.

Tree species and age were obtained from the timber stand inventory supplied by the landowner. The length of stream corridor occupied by a given stand was measured on the 1:24,000 scale Vegetation Overlay. Stream corridors which had different age stands on either bank were assigned half of the total stream length to each stand.

The riparian area condition (RAC) rating was then calculated by weighting the age of each riparian timber stand by the length of stream corridor occupied. For example, a RAC rating of 100 indicates that the entire length of stream corridor contains 100 year old trees, while a rating of one means that the entire stream corridor contains one-year old trees.

Disturbance History

Roads. Road locations in the watershed were determined using 1:12,000 scale 1985 aerial photos and maps supplied by landowners. During field review roads were divided into three classes: main gravel-surfaced, arterial gravel-surfaced; and temporary spurs. A Road Overlay was then created. Road lengths in each class were measured; road

density was calculated as the length of road (in miles) divided by the watershed area (in square miles).

Mass Wasting. Landslides were inventoried using 1965, 1982, and 1985 aerial photos. The November 8 field review provided further verification of landslide activity. The location of mass wasting areas is shown on the Miscellaneous Features Overlay. The Miscellaneous Features database (Appendix E) lists each mass wasting area, acreage involved, year of origin, condition, source of information, and comments for each feature.

Fires, Floods, and Other Disturbances. Local land managers and the Nisqually Indian Tribe were contacted to obtain information on past disturbances, including fire and floods. Data from tbe gaging station on the lower Mashel River near La Grande was also examined for information regarding extreme flood events.

Land and Water Use

Dams, Mining, Etc. Field investigation and aerial photos were used to check for past or active dams and mining activities affecting the basin. Gravel pit locations were indicated on the timber stand inventory maps supplied by the landowners and included in the Vegetation Overlay and database.

Miscellaneous Features. The location of lakes, wetlands, and other miscellaneous features was also included in the timber stand inventories provided by individual landowners. This information was further verified through examination of 1985 1:12,000 scale aerial photos. These features are mapped on the Vegetation Overlay and entered into the Vegetation database.

Results

Watershed Characteristics

Climate

Elevation. Mean elevation of the basin is 2,800 feet. Elevation ranges from 1,610 feet at the junction with Busy Wild Creek to 4,877 feet at the highest point on the watershed divide. Net relief is 3,267 feet.

Precipitation. Monthly precipitation and depth of snowfall is presented in Table 1 and Figure 1. Average annual precipitation for the watershed is 82.5 inches and average annual depth of snowfall is 180.2 inches. The snowfall depth does not reflect actual accumulation of the snowpack on the ground but, rather, the sum of individual snowfall events.

Table 1. Mashel River Above Busy Wild Creek Watershed Climatic Data Summary

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precipitation (inches)	12.22	8.E.s	8.05	5.22	4	3.6	1.38	2.18	4.08	7.88	11.38	13.71	82.5
Snowfall	48.59	34.59	31.45	9.81	1.02	0.01	0	0	0.03	1.4	13.91	38.11	180.15
Max Temperature (degrees F)	44	SO	58	62	71	76	a3	85	78	70	56	45	58
Min. Temperature	12	20	23	27	32	39	44	44	39	32	25	21	33

Note: Elevation/area-weighted average of two nearby stations: Rainier Longmire at 2760 feet and Electron Headworks at 1730 feet.

2-year, 24-hour precipitation: 0.35 inches, basin average (range of 0.30 at month to 0.37 in headwaters).

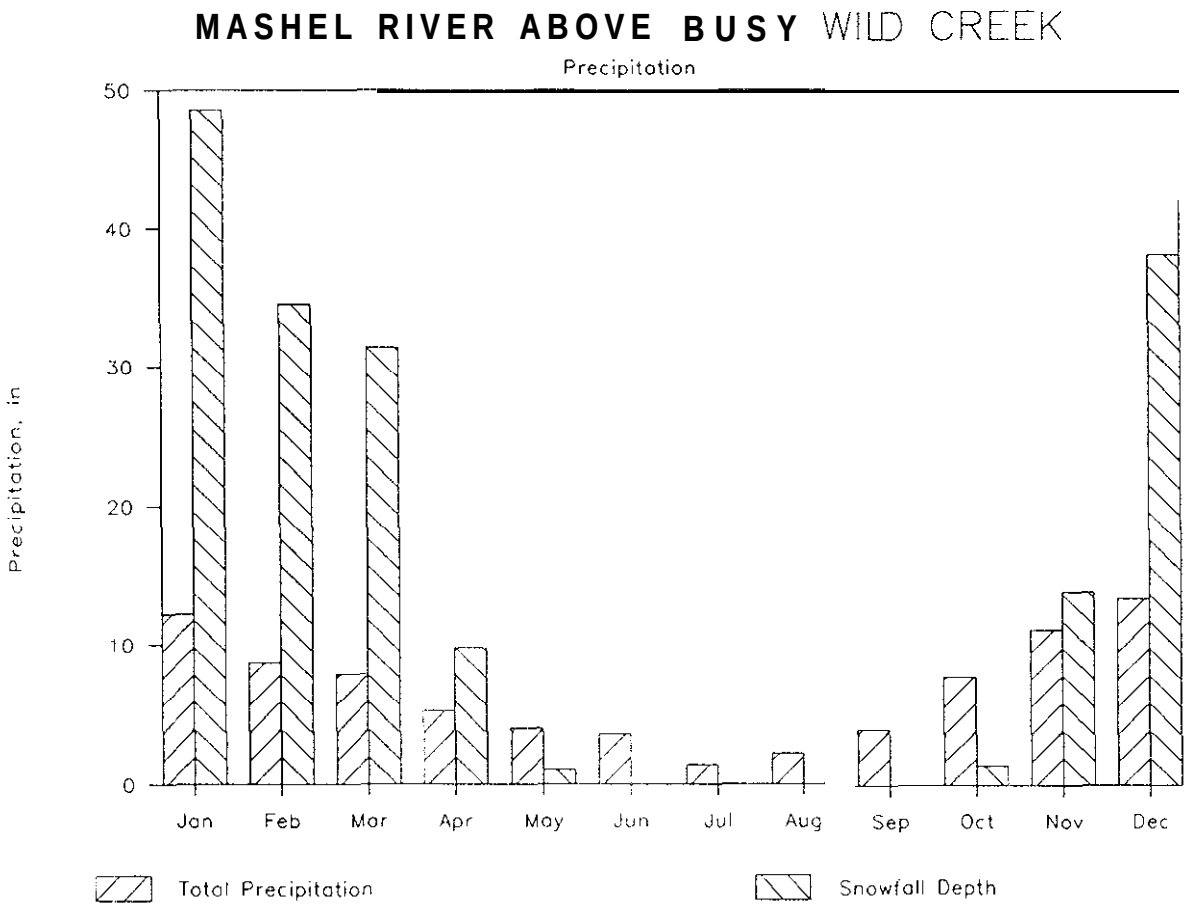

Figure 1. Monthly Precipitation Calculated for the Upper Mashel River Watershed.

Air Temperature. Average maximum and minimum monthly temperatures are presented in Table 1 and Figure 2. The average annual maximum temperature is 58 degrees Fahrenheit and the average annual minimum temperature is 33 degrees Fahrenheit.

Water Temperature. No water temperature data for the upper Mashel River was available.

Geology. Table 2 displays the geologic makeup of the watershed. Continental sedimentary rocks dating from the middle to upper Eocence underlie the eastern portion of the basin. Younger, lower Oligocene to upper Eocene-age volcaniclastic rocks and andesite flows underlie the central and western portions of the basin, respectively. More recent andesite intrusions are scattered throughout these formations.

Soils. The Soils Overlay and database display the location and properties of soils within the watershed. In an undisturbed state, nearly all soils within the watershed are rated as stable (Table 3). However, after disturbance by road construction or landings and/or by timber harvesting, the soils on 52% of the watershed are rated as unstable or very unstable.

The hazard for accelerated erosion of cut slopes, fill slopes, or sidecast material is rated as slight on 1,141 acres (10%); moderate on 8,713 acres (74%); and severe on 1,843 acres (16%). Area unsuitable for road construction amounts to 149 acres. The timber harvest-related erosion potential is rated as low on 372 acres (3%); medium on 9,303 acres (78%); and high on 2,119 acres (18%). Area unsuitable for timber harvest amounts to 52 acres. These ratings have been developed by the Washington Department of Natural Resources (1974) for the South Puget Region. They are explained. in more detail in Appendix C.

Site index classes for the watershed are displayed in Table 4. Site index is a designation of the quality of a forest site based on the height of the tallest trees in a stand at 50 or 100 years of age. The average site index for Douglas-fir stands is 110, and the average for western hemlock stands is 84.

Hydrology

Drainage Network and Basin **Dimensions.** The upper Mashel River is a fourth-order stream with a watershed area of 11,846 acres. Two overlays were constructed to display the watershed boundaries and stream orders. The watershed contains 25.6 miles of first-order streams, 4.8 miles of second-order streams, 6.5 miles of third order-streams, and 1.2 miles of fourth-order stream. Drainage density for the 18.5 square-mile watershed is 2.0 miles per square mile.

The watershed has a westward orientation. Basin length is 25,000 feet and basin width is 34,000 feet. The relief ratio is 0.13.

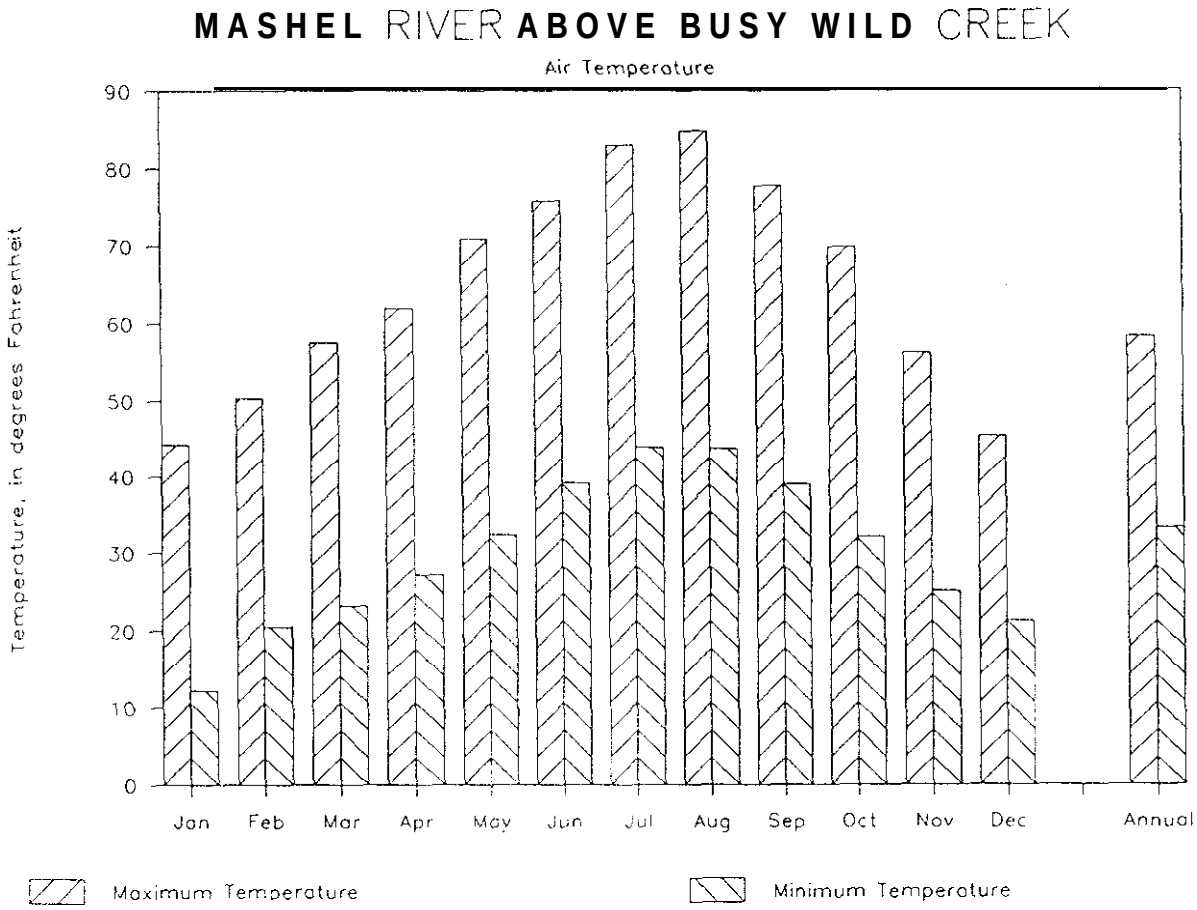

Figure 2. Average Monthly Maximum and Minimum Air Temperature for the Upper Mashel River Watershed

Table 2. Geologic Mapping Units within the Upper Mashel River Watershed (from Walsh et al. 1987)

Unit/Symbol	Description	General Category	Acres	%
MOvt	Miocene-Oligocene tuff	Volcanic	228	2
MOian	Miocene-Oligocene intrusive andesite	Intrusive	762	6
OEva	Lower-Oligocene to upper Eocene andesite flows	Volcanic	1810	15
OEvc	Lower-Oligocene to upper Eocene volcaniclastic rocks	Volcanic	4930	42
Ec2	Middle to upper Eocene continental sedimentary rocks	Sedimentary	4116	35

Table 3. Soil Stability Characteristics within the Upper Mashel River Watershed

	Natural Stability	Disturbed Stability
Stable	11,794 (99%)	5,564 (47%)
Unstable	1.3 (4%)	6,230 (52%)
Very Unstable	--	13 (<1%)
Not rated'	39 (4%)	39 (<1%)

[1] Includes rock outcrops and rubbleland.

Expressed as acres and percent of watershed area. Ratings are from the State Soil Survey Report for the South Puget Sound Area (WDNR, 1974)

Table 4. Site Index within the Upper Mashel River Watershed

Index Species	Site Index	Acres	% of Watershed
Douglas-fir	90 to 100	2,958	25%
	101 to 110	458	4%
	111 to 120	854	7%
	121 to 130	3,610	30%
	131 to 140	123	1%
Western hemlock	61 to 70	633	5%
	71 to 80	0	0%
	81 to 90	1,386	12%
	91 to 99	1,662	14%
Sites with no developed soil		162	1%

Flow. A summary of the flow data computed for the upper Mashel River is provided in Table 5. A summary of the daily flow measurements from the USGS gage at the mouth of the Mashel River near La Grande are included in Appendix A.

Average annual flow is 53 cubic feet per second (cfs). This translates to an average annual runoff of 2.9 cfs per square mile. The maximum computed flow for the period of record is 1,281 cfs, while the minimum is 2 cfs. The two-year flood flow was calculated to be 575 cfs.

Figure 3 displays the daily hydrograph for the basin. Highest flows occur between late November and early March, while the lowest flows occur from August through mid-September. The flow duration curve represents the exceedance probability of measured values, adjusted for the subbasin area. The flow duration curve, as shown in Figure 4, was not fitted to a smooth curve.

Existing Studies. Aside from the measurement of streamflow at the USGS gaging station, no instream flow studies have been conducted in the watershed.

A stream survey was conducted by a Northwest Indian Fisheries Commission crew with cooperation from the Nisqually Indian tribe during the summer of 1990. The crew collected information on habitat unit distribution, channel substrate, habitat modifiers, and riparian vegetation according to a procedure described in the Timber/Fish/Wildlife Stream Ambient Monitoring Field Manual (Ralph, 1990). The stream survey was conducted from the junction with Busy Wild Creek, upstream to a tributary junction at river mile (RM) 2.6.

A "Watershed and Stream Channel Cumulative Effects Assessment" project (Timber/Fish/Wildlife contract administered through the WDNR) is currently being conducted in the upper Mashel River watershed by Dave Somers and Ginette Smith of the Tulalip Tribe. This study examines riparian canopy opening and landslide initiation areas in the basin.

The upper Mashel River watershed is also a part of the Nisqually Resource Management Plan (RMP) project. The Nisqually RMP is a joint effort involving Champion International, Weyerhauser Company, Washington Department of Natural Resources, Nisqually Indian Tribe, Washington Department of Fisheries, Washington Department of Wildlife, Washington Department of Ecology, Washington Forest Protection Association, Nisqually River Council, Washington Environmental Council. and University of Washington's Pack Forest. Included in the Nisqually RMP is information concerning water type, unstable soils, stand year of origin, proposed forest practice applications (FPA's), surface water rights, and the location of wetlands and streams.

Geomorphology

Slope Classes. The Slope Overlay displays the distribution of slope classes in the watershed. The acreage of each cell on the Overlay, according to slope class, is provided in Appendix B.

Table 5. Mashel River Above Busy Wild Creek Calculated Daily Streamflow Summary

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Avg.	30	75	101	82	94	72	69	52	39	14	6	10	53
D Max	267	630	1281	660	605	499	239	290	258	120	33	105	1281
D Min.	2	2	3	7	6	10	10	7	5	2			

Based on USGS Gage 12087000, Mashel River near La Grande, Washington.

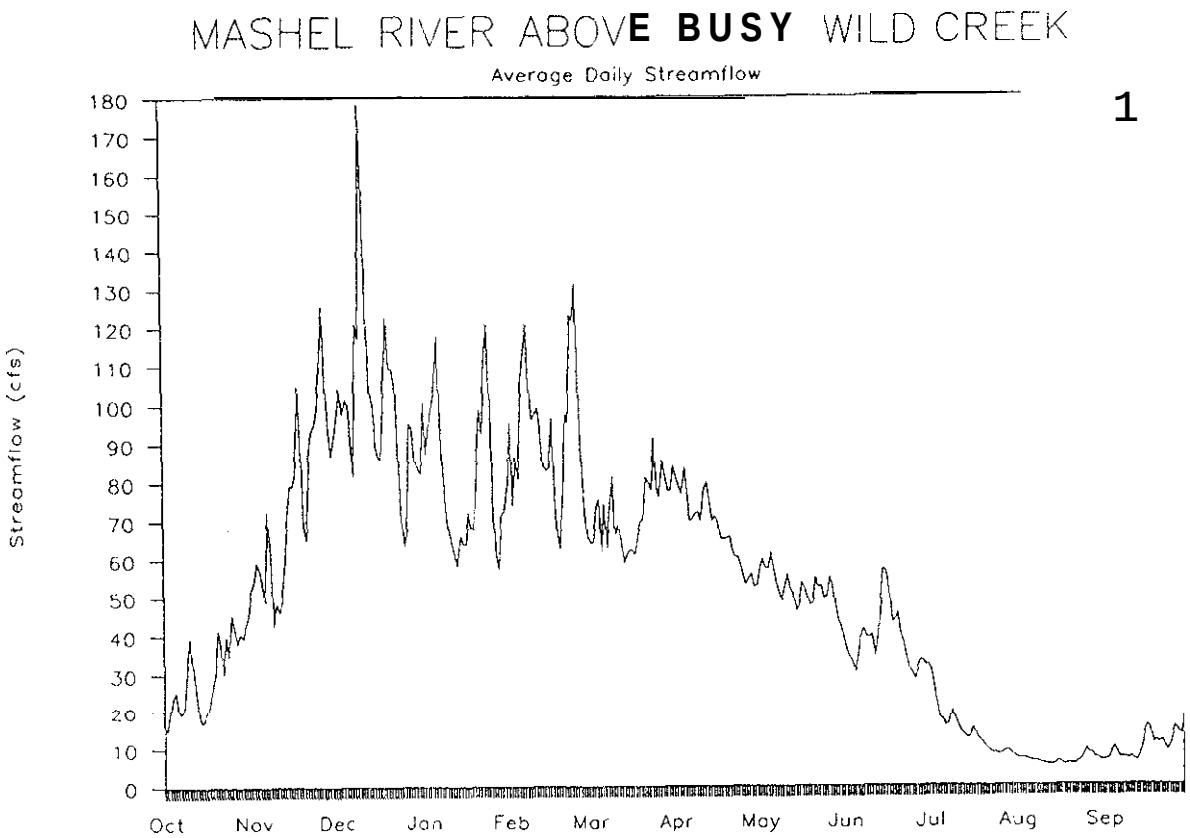

Figure 3. Daily Hydrograph for the Mashel River above Busy Wild Creek.

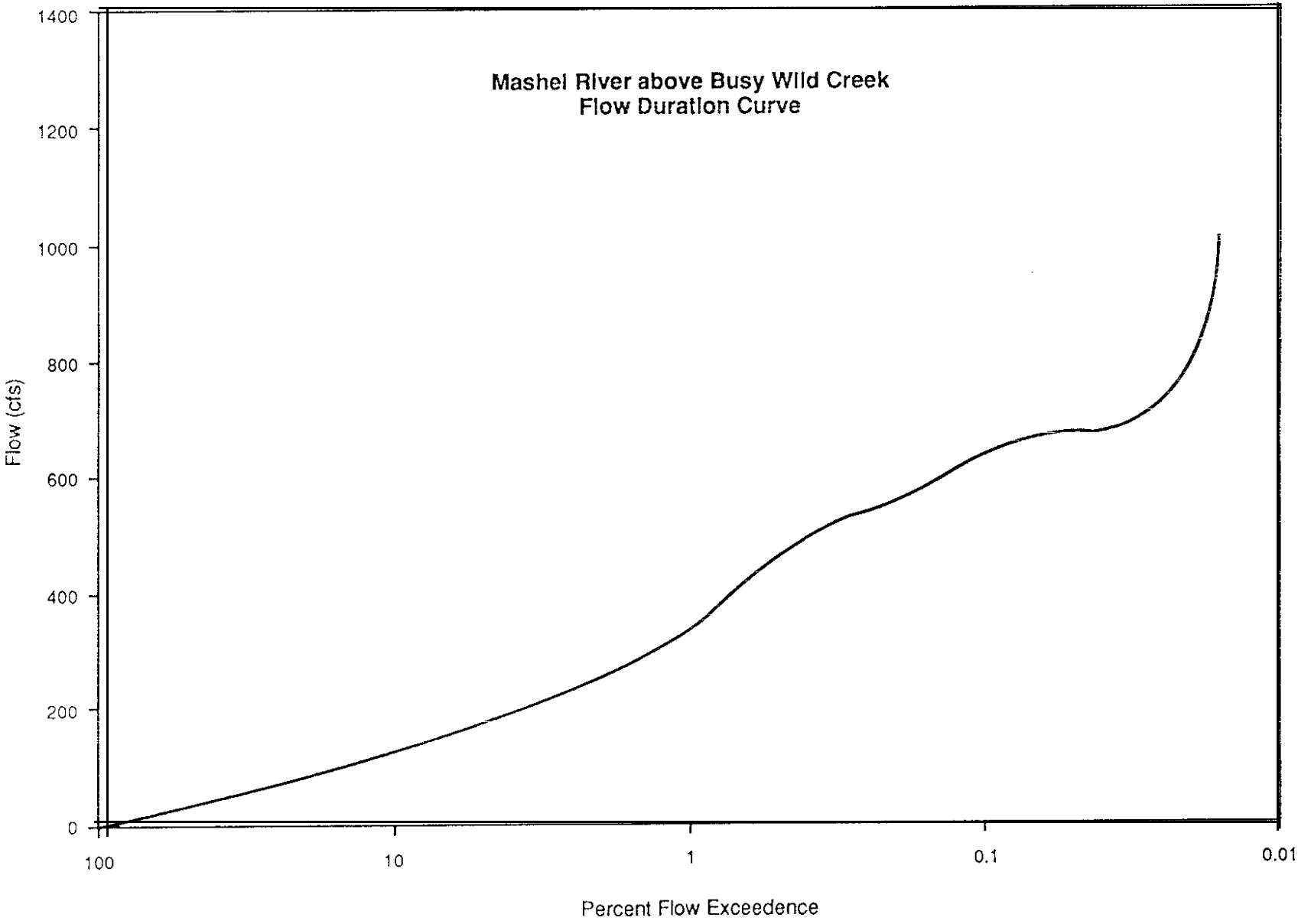

Figure 4. Flow Duration Curve for the Mashel River above Busy Wild Creek.

Table 6 lists the acreage of land in the slope classes. Half of the watershed is moderately steep, with a slope of 30% to 65%. Ninety percent of the watershed has a slope of less than 65% and less than 1% of the basin is flat (0% to 5%) or very steep (>90%).

Channel Profile. The channel profile is displayed in Figure 5. Data used to develop the profile are contained in Appendix B. A typical pattern of increasing slope from mouth to headwaters is exhibited by the channel. Values for channel slope are described in the following section.

Valley Segments. The distribution of valley segment types is shown on the Valley Segment Overlay. Table 7 describes the extent and slope of each valley segment type. For a complete explanation of valley segment characteristics, see Cupp (1989).

The major valley forming process has been dominated by fluvial, rather than glacial, activity. The resulting V-shaped valley consists of steep (40% to 60%) slopes bounding the lower 4.0 miles of the stream and moderate slopes (10% to 30%) along the upper reaches.

Within the lower 4 miles of V-shaped valley, the stream maintains an average gradient of 3%. This V-shaped valley was subdivided into two V1 segments separated by a V4 segment. Within the V1 segments, the stream is tightly confined by the steep valley walls, and the width of the valley floor is approximately equal to the active channel width. The V4 segment was delineated between. RM 1.5 and 2.6 where aggrddation has resulted in formation of an alluvial flat within the valley bottom that is approximately twice the active channel width. It should be noted that the upstream end of this alluviated *canyon* coincides with the mouth of the tributary where a debris flow occurred sometime after 1982. This debris flow deposited a large volume of sediment and woody debris in the mainstem Mashel, and washed out a bridge.

Watershed Conditions

Vegetation

Dominant Species and Timber Harvest Intensity. The Vegetation Overlay displays the location of the individual cells, with numbers that correspond to information about each cell in the Vegetation database. A complete listing from the Vegetation database is contained in Appendix D.

As shown in Table 8, 94% of the watershed consists of forested lands, with Douglas-fir *(Pseudotsuga menziesii)* and western hemlock *(Tsuga heterophylla)* being the dominant tree species. Virtually all of the forested lands in the watershed have been regeneration harvested (clearcut). Table 9 displays the acreage of forested lands in the watershed according to stand age.

Timber harvest began in the watershed in the 1930's, with a rapid increase in harvest activities beginning in 1950. The majority of the watershed had been harvested by the 1970's, but reforestation activities have continued into the 1980's. There are no pending

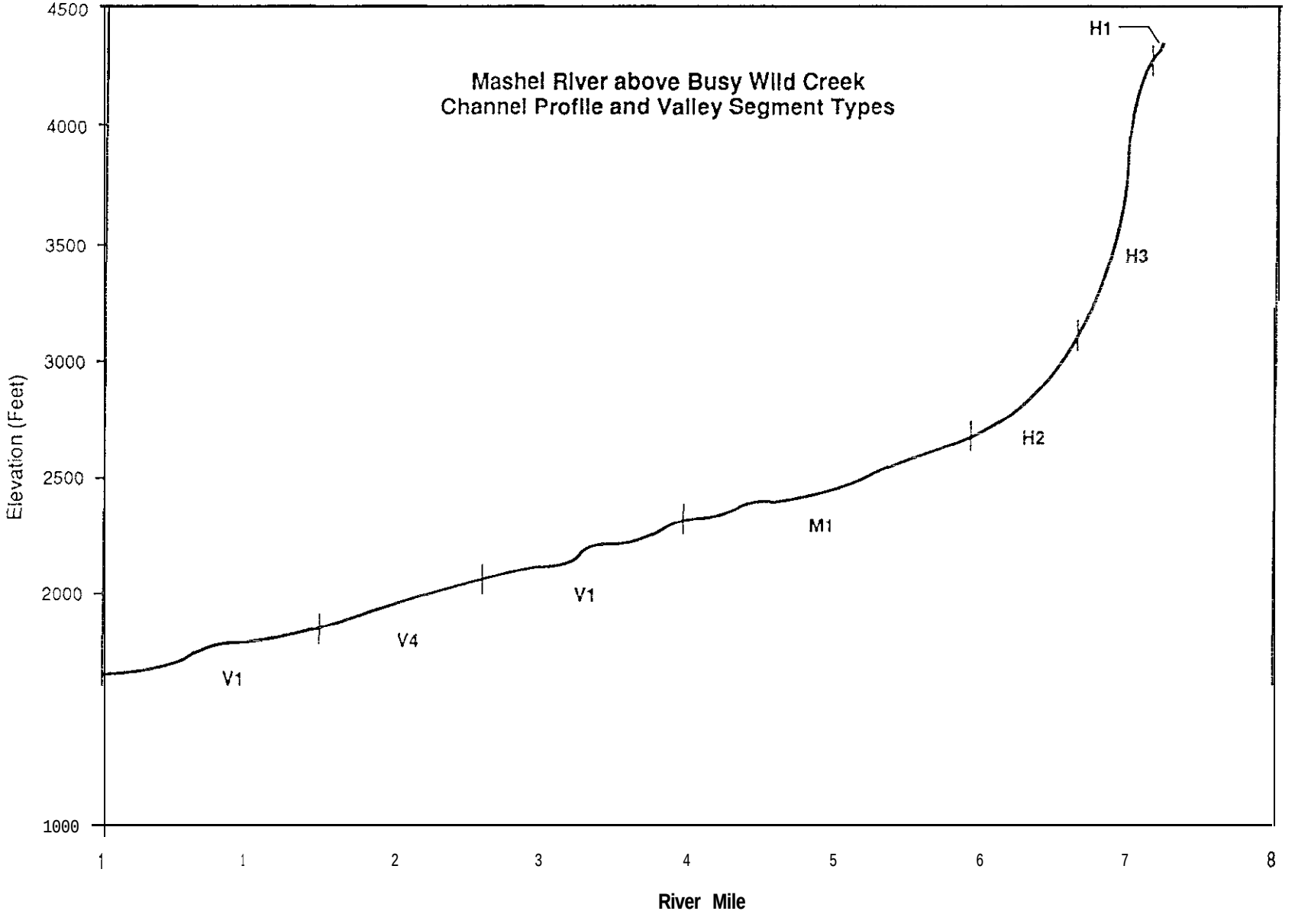

Figure 5. Mashel River Above Busy Wild Creek Channel Profile and Valley Segment Types.

Table 6. Slope Classes with the Upper Mashel River Watershed

Slope Class	Acres	% of Watershed
Oto 5%	82	<1%
5 to 30%	4,763	40%
30 to 65%	5,911	50%
65 to 90%	1,079	9%
<90%	11	<1%

Table 7. Valley Segments of the Upper Mashel River Mainstem

Segment	Extent (River Mile)	Channel Slope
V1 - V-Shaped Moderate Gradient	0 to 1.5	3%
V4 - Alluviated Mountain Valley	1.5 to 2.6	3%
V1 - V-Shaped Moderate Gradient	2.6 to 4.0	3%
Ml. - Moderate Slope-Bound	4.0 to 5.9	4%
H2 - High Gradient Headwater	5.9 to 6.7	10%
H3 - Very High Gradient Headwater	6.7 to 7.1	50%
H2 - High Gradient Headwater	7.1 to 7.3	11%

Table 8. Acreage Occupied by the Dominant Tree Species within the Upper Mashel River Watershed

Dominant Species	Acres	Percent of Watershed
Douglas-fir	4,888	41%
Western hemlock	5,789	49%
True fir[1]	457	4%
Red alder	114	1%
Non-forest[2]	604	5%

[1] Includes noble fir *(Abies procera)* and Pacific silver fir *(Abies amabilis)*

[2] includes roads and landings, gravel pits, lakes, wetlands, brush patches, and rock outcrops.

Table 9. Stand Age of Forested Lands in the Upper Mashel River Watershed

Age as of 1990	Acres	Percent of Watershed
< 1 Year	22	--
01 to 10	2,214	19%
11 to 20	2,843	24%
21 to 30	3,973	34%
31 to 40	1,709	14%
41 to 50	195	2%
51 to 60	289	2%

Note: Non-forest lands = 5% of the watershed.

Forest Practice Applications (FPA's), since no mature timber is currently available in the watershed.

The majority of timber stands in the watershed are densely stocked, with more than 350 trees per acre (tpa). Stand densities are less than 250 tpa on 3,856 acres; 250 to 350 tpa on 1,165 acres; and greater than 350 tpa on 6,220 acres. Stands in the l-249 trees per acre class have generally been precommercially thinned, although this stocking density occurs on some stands at higher elevation, or sites underlain by shallow, rocky soils.

Riparian Condition. For much of its length, the riparian corridor of the upper Mashel River is confined within a narrow valley bottom. The most noticeable difference between the streamside and upland vegetation is a higher percentage of red alder *(Alnus rubra)* in the riparian zone. Currently, the dominant vegetation within the riparian area consists of 56% western hemlock, 28% red alder, 10% Douglas-fir, and 5% true firs (percentages by length of stream corridor). Table 10 displays the age distribution of the riparian vegetation.

The entire riparian corridor of the upper Mashel River has been clearcut between 1930 and 1980. No buffers were left along the mainstem, nor along any tributary streams during timber removal. The RAC rating for the upper Mashel River corridor is 26%.

Disturbance History

Roads. Extensive road construction has occurred in the upper Mashel River watershed to accommodate timber harvest activities. The Road Overlay displays the location and class of roads in the basin. As shown in Table 11, there are 104.5 miles of roads, equalling a road density of 5.6 miles per square mile.

Champion International has placed the majority of the watershed in a road management area (RMA). The RMA is set aside with very limited vehicle access in order to provide a quality recreational area as well as a wildlife refuge. Although the roads in the basin have not been physically closed or scarified, many of the temporary spurs are currently impassable to vehicles due to growth of red alder.

Sidecast failures are common in the northern portion of the basin. As shown in Table 12, seven failures were observed during field review, occupying approximately 22 acres. The location of these failures is displayed on the Miscellaneous Features Overlay and described in the Miscellaneous Features database (Appendix E).

Mass Wasting. Three debris flows were noted during field and aerial photo review. The term "debris flow" in this report denotes rapidly occurring mass wasting events which are transported primarily by water down a stream channel. These areas have been delineated on the Miscellaneous Features Overlay. The Miscellaneous Features database (Appendix E) contains information on these events.

Table 10. Age of Riparian Vegetation Along the Mainstem of the Mashel River, Measured from the Junction of Busy Wild Creek to Lake Mary Lea.

Age as of 1990	Length of Riparian Vegetation (ft.)	Percent of Riparian Area
01 to 10	5,375	14%
11 to 20	8,500	22%
21 to 30	11,150	28%
31 to 40	10,850	28%
41 to 50	1,750	4%
51 to 60	1,800	4%

Table 11. Length of Roads in the Upper Mashel River Watershed

Road Class	Miles
Main, gravel-surfaced	10.1
Arterial gravel-surfaced	75.2
Temporary spurs	19.2
Total length of roads	104.5

Table 12. Mass Wasting Features in the Upper Mashel River Watershed

Cell #	Name	Year or Origin	Status	Acres
4	debris flow	1989 to 90 winter	static	15
6	debris flow	post 1982	static	5
1	debris flow	post 1982, pre 1989	static	18
		Total acres in debris flow		38
2	sidecast failure	pre 1965	active	4
5	sidecast failure	pre 1982, post 1965	healing	3
7	sidecast failure	pre 1982, post 1965	active	10
8	sidecast failure	post 1982, pre 1989	active	1
9	sidecast failure	post 1982, pre 1989	active	1
10	sidecast failure	pre 1982	healing	1
3	sidecast failure	post 1965, pre 1982	healing	2
		Total acres in sidecast failures		22

In two cases, the debris flows washed out road crossing structures. In one case debris was deposited upstream of a culvert in a low gradient reach of the stream channel. The origin of debris flow #1 appears to have been a landing. The origin of the other two was not determined due to poor visibility during field review and lack of aerial photo coverage. Further information on landslide initiation areas will be available from the "Watershed and Stream Channel Cumulative Effects Assessment" being conducted by Somers and Smith.

Fires, Floods, and Other Disturbances. Indicators of fire history in the watershed have been lost due to the total timber removal strategy employed in the basin.

The highest flow on record for the Mashel River near La Grande occurred on December 11, 1947 when 5,570 cfs was recorded. This is more than twice the maximum flow recorded for the other 16 years of record, and likely represents a fairly low probability (high return period) event. It is likely that a high flow event also occurred in the upper Mashel River at this time.

Numerous west slope Cascade Mountain streams experienced extremely high flows following a rain-on-snow event that occurred November 24, 1990. Up to 7 inches of rainfall occurred in the higher elevations and, combined with warm temperatures and snowmelt, resulted in severe flood damage in low lying areas. The flow magnitude experienced in the study area was not determined, and no damage has been reported by the landowners.

Land and Water Use

Dams, Mining, Etc.. There are no dams within the watershed. The Mashel River enters the Nisqually River downstream of Alder Dam; access exists for anadromous fish to this system (Cliche, pers. comm.).

There is no evidence of past mineral mining activities within the watershed. Eight gravel pits occupy approximately 17.5 acres in the watershed.

Miscellaneous Features. Miscellaneous features in the watershed include non-forested brush lands, rock outcrops, four lakes, and four wetlands. The location of these features is shown on the Vegetation Overlay.

PART 2. CHARLEY CREEK

The Charley Creek watershed is located approximately 25 miles north of Mt. Rainier in the Green River watershed,. The 12.8-square mile watershed lies within Sections 3 to 11 and 15 to 22 of Township 20 N, Range 8 E; Sections 1 and 2 of Township 20 N, Range 7 E; and size Sections 33 and 34 of Township 21 N, Range 8 E.

Methods

Watershed Characteristics

Climate

Elevation. The watershed boundary was delineated on the Cyclone Creek and Eagle Gorge USGS 7 1/2 minute topographic maps. Basin relief and mean elevation were calculated in the same manner as described in Part 1.

Precipitation. Precipitation informationwas obtained from USGS Climatedata disks. The disks were searched to locate weather stations that are within 20 miles of Charley Creek and within the elevational range of the watershed. Three stations were selected: Cedar Lake at 1,560 feet, Snoqualmie Pass at 3,020 feet, and Stampede Pass at 3960 feet. A summary of average monthly precipitation and snowfall for each of these stations is included in Appendix A.

Average monthly precipitation and snowfall data from the three stations was weighted on an area basis to determine monthly and annual precipitation for the Charley Creek watershed. The area weighting method is described in Part 1.

The 2-year, 24-hour precipitation event for the watershed was determined by consulting the NOAA Precipitation Frequency Atlas (1970). Due to the large scale (1 inch = 20 miles) of the NOAA map, the entire basin was represented by one isopluvial.

Air Temperature. Air temperature information was obtained from the USGS Climatedata disks. Because daily temperature values were not available, average monthly values were used. Average monthly maximum and minimum temperatures for Cedar Lake, Snoqualmie Pass, and Stampede Pass were weighted on an area basis in the same manner as the precipitation data to determine temperatures for the Charley Creek watershed. A summary of the temperature information for the three stations is included in Appendix A.

Water Temperature. USGS stream monitoring records were consulted, but no water temperature data for Charley Creek was available.

Geology. The Geologic Map of Washington - Southwest Quad (Walsh et al. 1987 - original scale 1:250,000) and Preliminary Geologic Map of the Snoqualmie Pass quadrangle

(Frizzel et al. 1984 - original scale 1:100,000) were reproduced at a scale of 1:24,000 to construct the Geology Overlay of the watershed. Mapping unit boundaries displayed on the Geology Overlay should be viewed with the original scale of these maps in mind. The Geology Overlay is designed to provide a general characterization of the geologic makeup of the watershed, not a detailed investigation.

Soils. The Soils Overlay and database were developed in the same manner as described in Part 1.

Hydrology

Drainage Network and Basin Dimensions. Stream orders were completed for the watershed using the standard method developed by Strahler (1964) and previously explained in Part 1.

Watershed area was measured with a Planix planimeter. Charley Creek is a third-order stream, so it was not further divided into subwatersheds. Basin length was measured from the mouth to the drainage divide following the main channel. Basin width was measured at the midpoint of the channel, perpendicular to the direction of flow. Relief ratio was calculated as the basin relief divided by the length of the basin (Dunne and Leopold, 1978).

Flow. A USGS gage is located at RM 1.0 of Charley Creek, above the backwater influence of Howard Hanson reservoir. Ten years of daily streamflow data at this gage was obtained from USGS Hydrodata disks. A summary of the gaging data and daily flow values are included in Appendix A.

A daily hydrograph was constructed by averaging daily flow values for the ten year period of record (1947-1956). A flow duration curve was calculated by hierarchically ordering the actual daily values (from lowest to highest) to determine the percent of time each flow value was equalled or exceeded throughout the ten year period of record.

The average annual flow value was obtained from the USGS summary for the Charley Creek gaging station. The %-year return period flow was calculated using Weibull's formula (in Linsley et al. 1975), which relates return period to the rank of the event in order of magnitude and the number of years of record.

Existing Studies. Local land managers and the Muckleshoot Indian Tribe were contacted to determine whether any instream flow or other pertinent studies have been conducted on Charley Creek. The gaging station location period of record was obtained from the USGS Hydrodata disks. The location of this station is shown on the Miscellaneous Features Overlay.

Geomorphology

Slope Classes. 'The watershed was stratified into slope classes as described in Part 1.

Channel Profile. 'The methodology for constructing the channel profile is explained in Part 1.

Valley Segments. Valley segments were identified using the methodology developed by Cupp (1989) and previously described in Part 1.

Watershed Conditions

Vegetation

Dominant Species and Timber Harvest Intensity. Major landowners within the Charley Creek watershed were contacted to obtain timber stand species composition, age, and stand density. Original scale of the maps supplied by the landowners was 4 inches = 1 mile on National Forest lands and 1:12,000 for WDNR and Weyerhauser lands.

For many of the stands on WDNR land, basal area and average diameter at breast height (dbh), rather than trees per acre, was supplied by the landowner. In these cases trees per acre was calculated by dividing basal area by the area occupied by the average tree diameter.

Vegetation information for a small area of the watershed was interpreted from aerial photos. This included land owned by Burlington Northern, Seaboard Lumber Company and the City of Tacoma. Stand composition, age and density was determined by comparing these stands to adjacent stands for which information had been supplied by the landowner. A comment to this effect is included in the database (Appendix D).

Stand maps supplied by the landowners were re-drafted onto mylar overlays. Some difficulty was encountered in precisely matching section lines with the maps supplied by the landowners to those on the USGS quadrangles. Accuracy of the stand lines is estimated to be within 40 feet of actual stand boundaries.

The final overlays consist of a series of numbered cells which are keyed to a Dbase database that contains information on cell acreage, dominant and subdominant species, year of origin, and trees per acre. Also included in the database is locational information, including WRIA, subwatershed, legal description, ownership, and identification number assigned by the landowner. The comments section in the database identifies stands for which vegetation information was interpreted from aerial photos.

Aerial photos and a November 20 field investigation verified the data. Particular attention was given to ensuring that recent harvest activities were accurately portrayed.

Riparian Condition. Riparian stand species and ages were determined from the mouth of Charley Creek, upstream to the headwaters. Tree species and age were obtained from the timber stand inventory supplied by the landowner. The length of stream corridor occupied by a given stand was measured on the 1:24,000 scale Vegetation Overlay.

Stream corridors which had different age stands on either bank were assigned half of the total stream length to each stand..

The RAC rating was then calculated by weighting the age of each riparian timber stand by the length of stream corridor occupied. For example, an RAC rating of 100 a RAC rating indicates that the entire length of stream corridor contains 100-year old trees, while a rating of 1 means that the entire stream corridor contains one-year old trees.

Disturbance History

Roads. The location of roads in the watershed was determined using 1: 12,000 scale 1989 aerial photos. The photos were reduced to 1:24,000 scale to develop the Road Overlay. During field review, the roads were divided into three classes: main gravel-surfaced, arterial gravel-surfaced; and temporary spurs. The length of roads in each class was measured and road density was calculated as the length of road divided by the watershed area.

Mass Wasting. Landslides were inventoried using 1985 and 1989 1:12,000 scale aerial photos. The November 20 field review also provided the opportunity for further verification of mass wasting activity.

Fires, Floods, and Other Disturbances. Local land managers and the Muckleshoot Indian Tribe were contacted to obtain information on past disturbances, including fire and floods. The data from the gaging station near the mouth of Charley Creek was also examined for information regarding extreme flood events.

Land and Water Use

Dams, Mining, Etc.. Field investigation, aerial photo review, and local contacts were used to check for past or active dams and mining activities affecting the basin. The location of gravel pits was supplied by the landowners.

Miscellaneous Features. The location of lakes, wetlands, powerlines, and other miscellaneous features was included in the timber stand inventories supplied by individual landowners. This information was further verified through examination of 1989 1:12,000 scale aerial photos. These features are mapped on the Vegetation Overlay and included in the Vegetation database (Appendix D).

Results

Watershed Characteristics

Climate

Elevation. Mean elevation of the basin is 2,720 feet. Elevation ranges from 1,140 feet where Charley Creek enters Howard Hanson Reservoir to 4,382 feet at the radio tower on the watershed divide. Net relief is 3,242 feet.

Precipitation. Monthly precipitation and depth of snowfall is presented in Table 13 and Figure 6. Average annual precipitation for the watershed is 102.8 inches and average annual depth of snowfall is 336.7 inches. The snowfall depth does not reflect actual accumulation of the snowpack on the ground but, rather, the sum of individual snowfall events.

Air Temperature. Average maximum and minimum monthly temperatures are presented in Table 13 and Figure 7. The average annual maximum temperature is 55 degrees Fahrenheit and the average annual minimum temperature is 31 degrees Fahrenheit.

Water Temperature. No water temperature data for Charley Creek was available.

Geology. Table 14 displays the geologic makeup of the watershed. Oligocene-age volcaniclastic rocks underlie the western portion of the basin. Intrusive rocks dating from the Miocene age appear within this older formation. Miocene-age andesite flows form the foundation for the eastern portion. Landslide debris of more recent origin occurs on the east side of the lower basin, however, examination of aerial photos did not display any evidence of ongoing instability in this location.

Soils. The Soils Overlay and database display the location and properties of the soils within the watershed. In an undisturbed state, nearly all soils within the watershed are rated as stable (Table 15). However, after disturbance by the construction of roads or landings, and/or by timber harvesting, the soils on 33% of the watershed are rated as unstable, and a very small percentage is rated as very unstable.

The hazard for accelerated erosion of cut slopes, fill slopes, or sidecast material is rated as slight on 785 acres (10%); moderate on 4,944 acres (60%); and severe on 2,449 acres (30%). Areas unsuitable for road construction amounted to 49 acres. The timber harvest-related erosion potential is rated as medium on 7,752 acres (94%); and high on 424 acres (5%). Areas unsuitable for timber harvest amounted to 51 acres; there were no soils with a low timber harvest erosion potential. These ratings have been developed by the Washington Department of Natural Resources (1974) for the South Puget Region. They are explained in more detail in the soils database description, Appendix C.

Site index classes for the Charley Creek watershed are displayed in Table 16. Site index is a designation of the quality of a forest site based on the height of the tallest trees in a stand at the age of 50 years. The average site index for Douglas-fir stands is 111, and the average for western hemlock is 74.

Table 13. Charley Creek Watershed Climatic Data Summary

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precipitation (inches)	15.0	11.7	10.6	6.6	4.7	4.3	1.8	2.4	5.0	9.4	14.2	16.4	102.8
Snowfall Depth	81.4	62.2	58.7	22.8	4.9	0.2	0.1	0.0	0.3	6.4	35.3	69.6	336.7
Mar Temperature (degrees F)	40	47	52	59	68	71	79	80	73	65	49	40	55
Mii. Temperature	7	12	21	27	33	37	43	43	39	31	21	18	31

Note: Elevation/area-weighted average of three nearby stations: Cedar Lake at 1560 feet, Snoqualmie Pass at 3020 feet, Stampede Pass at 3960 feet.

2-year, 24-hour precipitation: 0.35 inches throughout the basin.

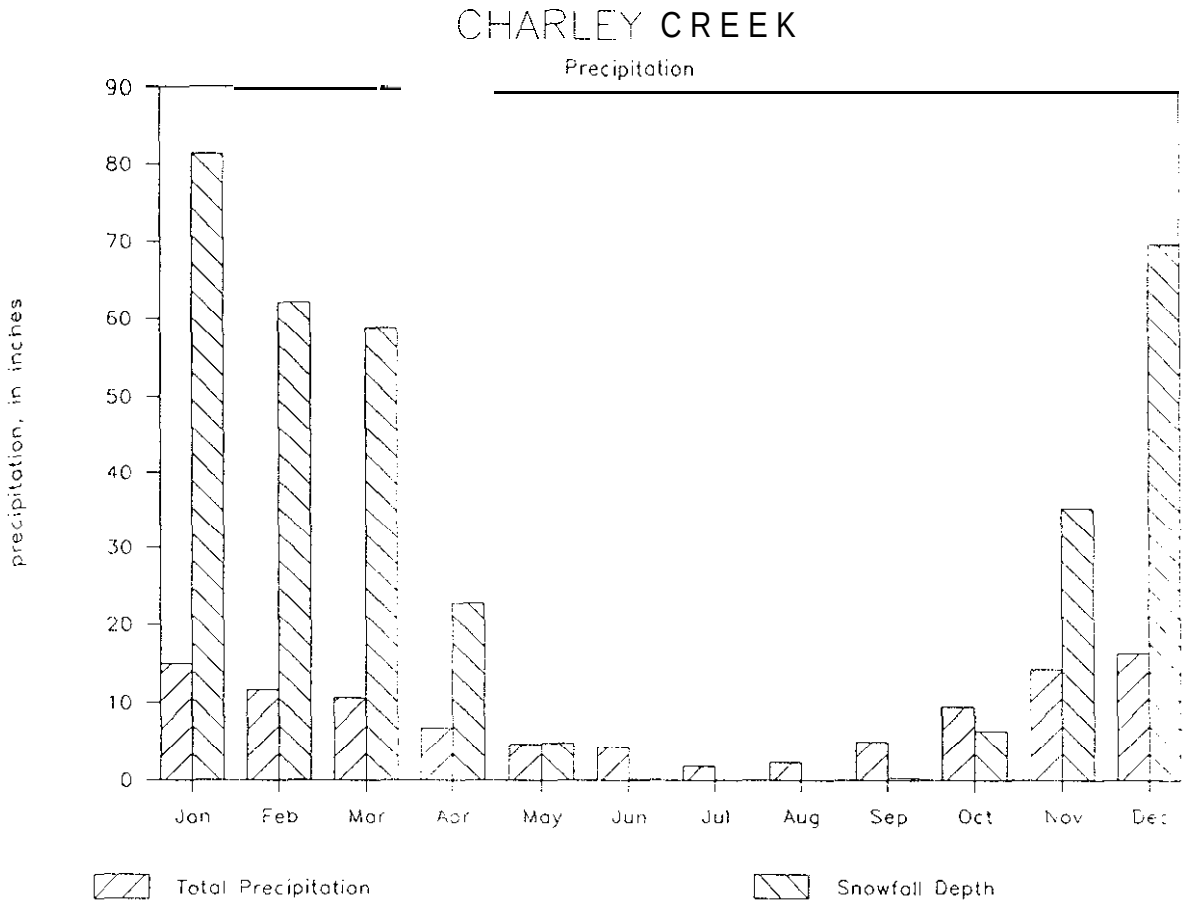

Figure 6. Monthly Precipitation Calculated for the Charley Creek Watershed,

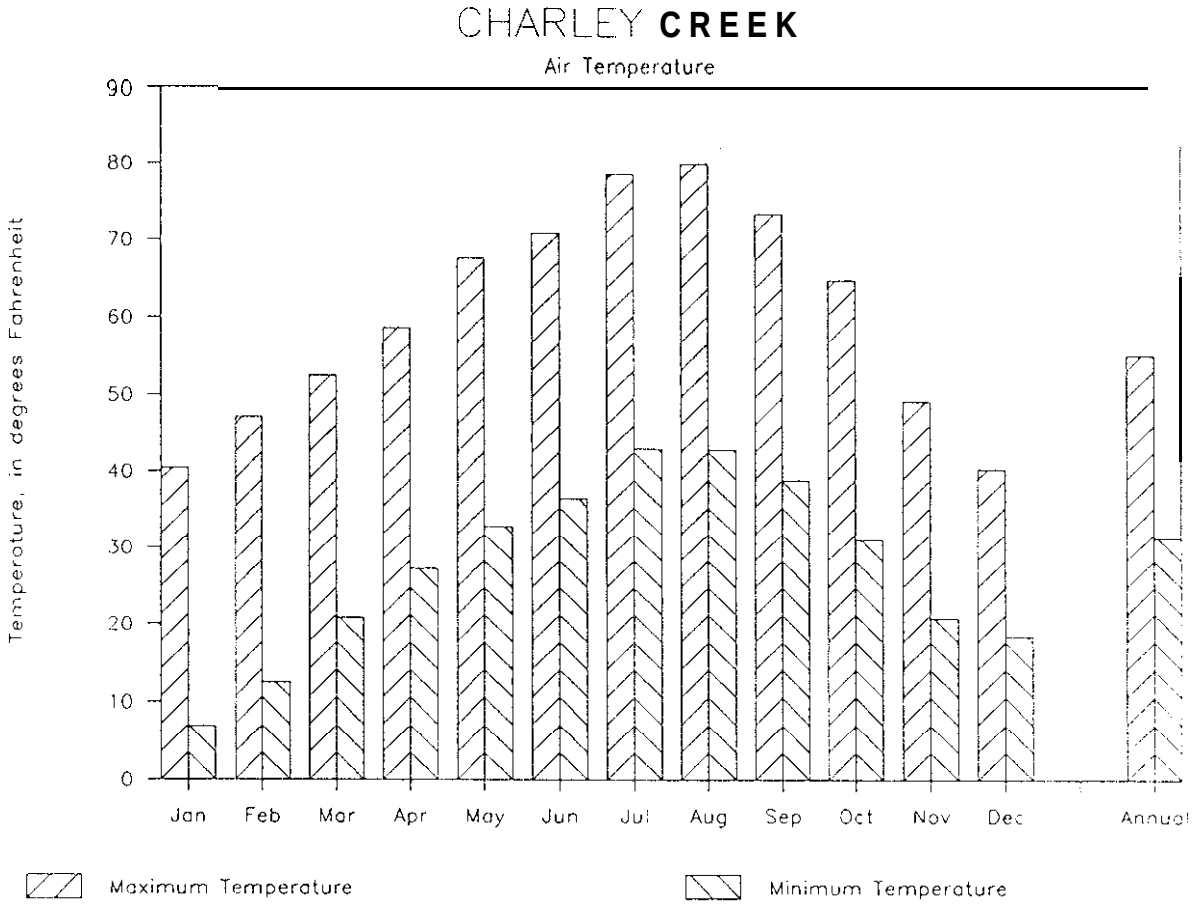

Figure 7. Average Monthly Maximum and Minimum Air Temperature for the Charley Creek Watershed.

Table 14. Geologic Mapping 'Units within Charley Creek Watershed (from Frizzel et al. 1984 and Walsh et al. 1987)

Unit/Symbol	Description	General Category	Acres	%
Qa	Quatemary alluvium	sedimentary	32	<1%
Qls	Quaternary landslide debris	sedimentary	908	11%
Mva	Miocene andesite flows	volcanic	2,005	24%
Mia	Miocene acidic intrusive rocks	intrusive	193	2%
ovc	Oligocene volcaniclastic rocks	volcanic	5,089	62%

Table 15. Soil Stability Characteristics within the Charley Creek Watershed

	Natural Stability	Disturbed Stability
Stable	8176 (99%)	5,464 (66%)
Unstable	2 (4%)	2,703 (33%)
Very Unstable	-	11 (<1%)
Not Rated[1]	49 (4%)	49 (<1%)

[1] Includes rock outcrops and rubbleland

Note: Expressed in acres and percent of watershed area. Ratings are from the State Soil Survey Report for the South Puget Sound area (WDNR, 1974)

Table 16. Site Index for Charley Creek Watershed

Index Species	Site Index	Acres	% of Watershed
Douglas-fir	100 to 110	2173	26%
Douglas-fir	111 to 120	735	9%
Western hemlock	60 to 70	1034	13%
Western hemlock	71 to 80	3630	44%
Western hemlock	81 to 90	487	6%
Sites with no Developed Soils		168	2%

Hydrology

Drainage Network and Basin Dimensions. Charley Creek is a third-order stream with a watershed area of 8,227 acres. General orientation of the basin is North. Two overlays display the watershed boundary and stream orders. The Charley Creek watershed contains 16.3 miles of first-order streams, 4.4 miles of second-order streams, and 0.3 miles of third order stream. Drainage density for the 12.8 square mile watershed is 1.9 miles per square mile.

Basin width is 21,000 feet and basin length is 21,500. The relief ratio is 0.15.

Flow. A summary of ten years of gaging data on Charley Creek is provided in 'Table 17. Average annual flow is 73 cfs. This translates to an average annual runoff of 6.4 cfs per square mile. The maximum flow for the period of record is 1,240 cfs, while the minimum is 7 cfs. The two-year flood flow was calculated to be 684 cfs.

Figure 8 displays the daily hydrograph for the basin. Highest flows occur in two distinct periods during December and February, while lowest flows occur from August through September. The flow duration curve for the basin is shown in Figure 9.

Existing Studies. Aside from the measurement of streamflow at the USGS gaging station, no instream flow studies have been conducted in the watershed.

A stream survey was conducted by a Northwest Indian Fisheries Commission crew with cooperation from the Muckleshoot Indian tribe during the summer of 1989. The crew collected information on habitat unit distribution, channel substrate, habitat modifiers, and riparian vegetation according to a procedure described in the Timber/Fish/Wildlife Stream Ambient Monitoring Field Manual (Ralph, 1990).

Geomorphology

Slope Classes. The Slope Overlay displays the distribution of slope classes in the watershed. The acreage of each cell on the overlay, according to slope class, is provided in Appendix B.

Table 18 displays acreage of land in the slope classes. Approximately half of the watershed is moderately steep, with a slope of 30% to 65%. Eighty seven percent of the watershed has a slope of less than 65% and less than 1% of the basin is flat (0% to 5%) or very steep (> 90%).

Channel Profile. The channel profile is displayed in Figure 10, while the data used to develop the profile are contained in Appendix D. A typical pattern of increasing slope from mouth to headwaters is exhibited by the channel. Values for channel slope are displayed in Table 19.

Valley Segments. The distribution of valley segment types is shown on the Valley Segment Overlay. Table 19 describes the extent and slope of each valley segment type. For a complete description of valley segment characteristics, see Cupp (1989).

Table 17. Charity Creek Daily Streamflow Summary

	Oct	NO"	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Avg	54	96	111	94	109	68	98	97	77	34	22	20	13
D Max	411	515	1240	678	971	556	317	299	328	177	99	117	1240
D Min	7	7	7	16	21	21	40	22	19	13	11	10	7

Note: Period of Record **1947 to 19%.**

Table 18. Slope Classes within the Charley Creek Watershed

Slope Class	Acres	Percent of Watershed
0 to 5%	18	0.2%
5 to 30%	2682	33%
30 to 65%	4419	54%
65 to 90%	985	12%
>90%	19	0.2%

Table 19. Valley Segments on the Mainstem of Charley Creek

Segment	Extent (River Mile)	Channel Slope
M1 - Moderate Slope-Bound	0 to 1.0	4%
VI - V-Shaped Moderate Gradient	1.0 to 2.4	3%
V2 - V-Shaped Steep Gradient	2.4 to 3.1	7%
V1 - V-Shaped Moderate Gradient	3.1 to 3.9	4%
V2 - V-Shaped Steep Gradient	3.9 to 4.4	7%
H1 - Moderate Gradient Headwater	4.4. to 5.0	10%
H3 - Very High Gradient Headwater	5.0 to 6.1	19%

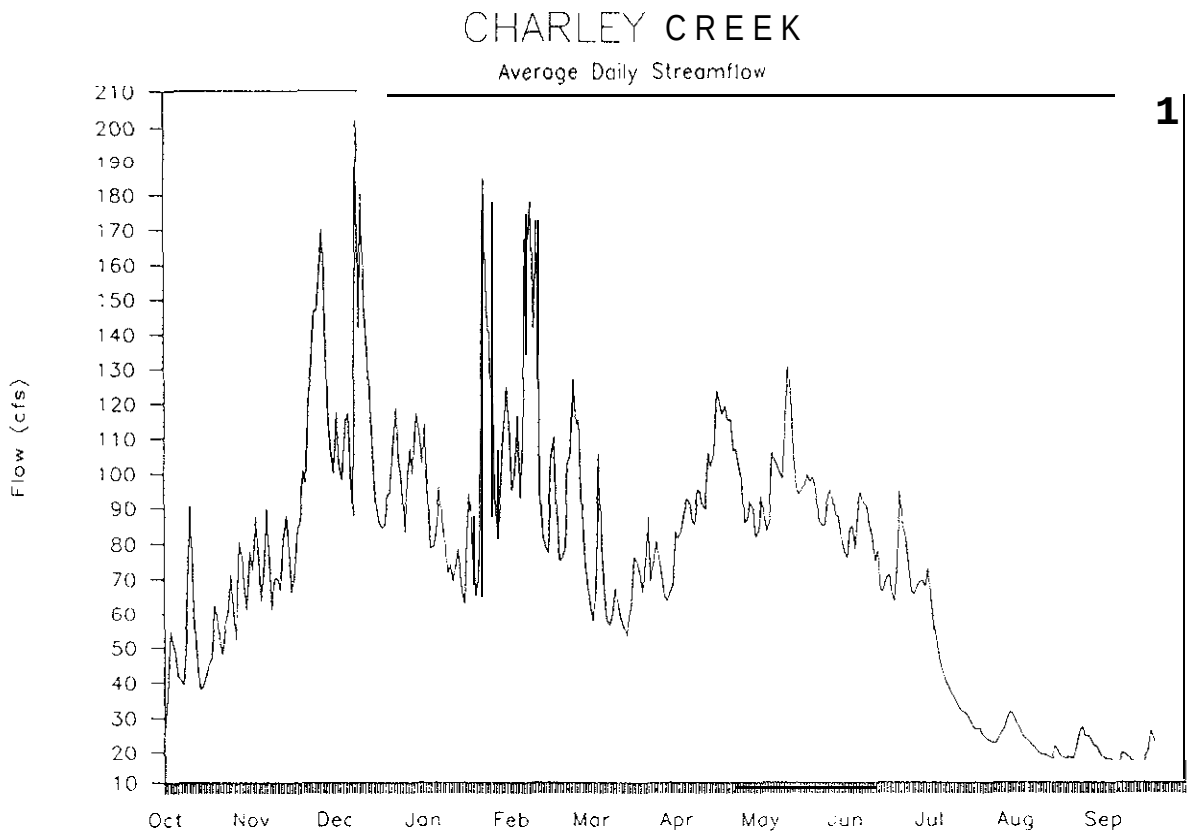

Figure 8. Daily Hydrograph for Charley Creek.

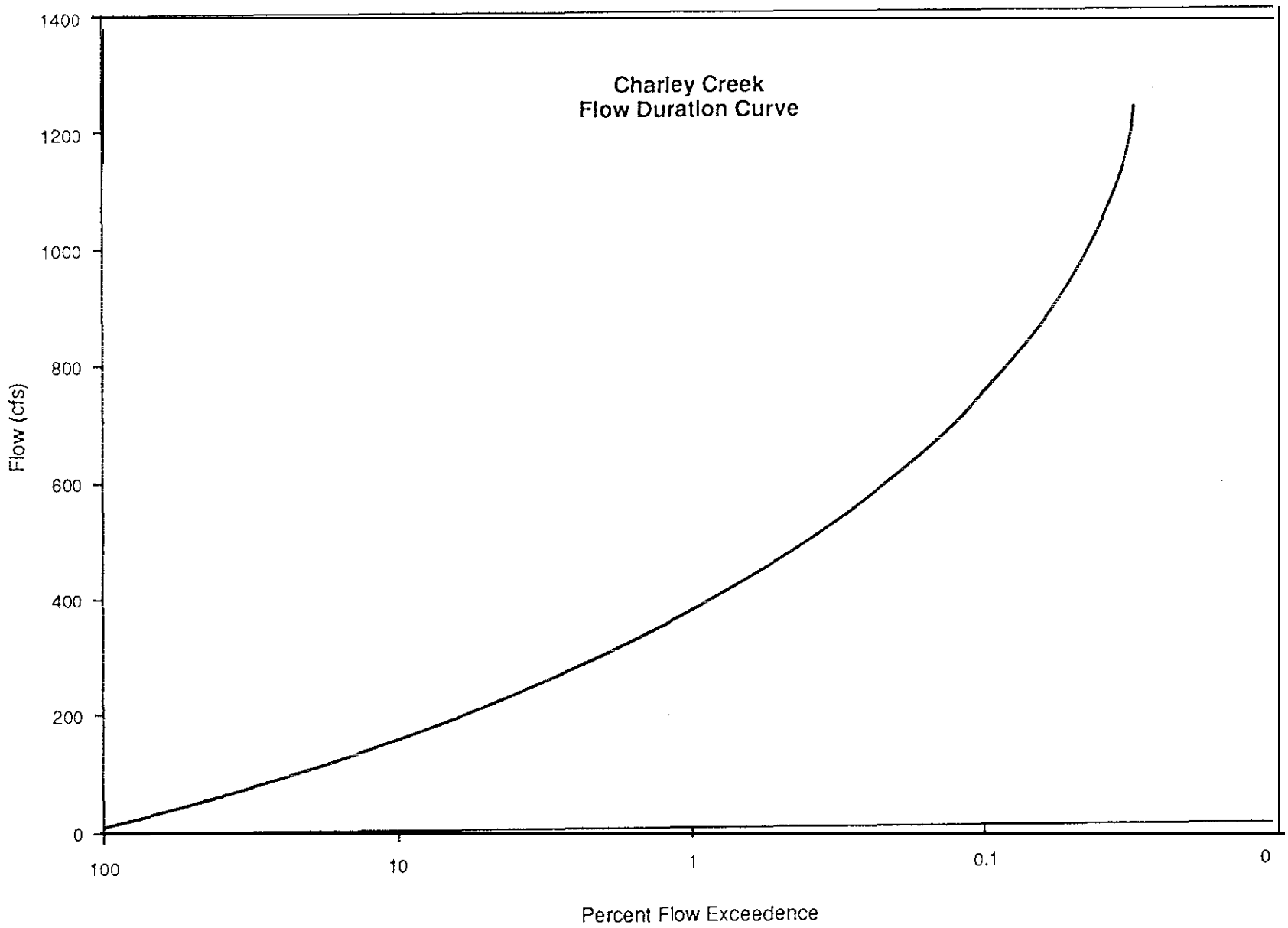

Figure 9. Flow Duration Curve for Charley Creek.

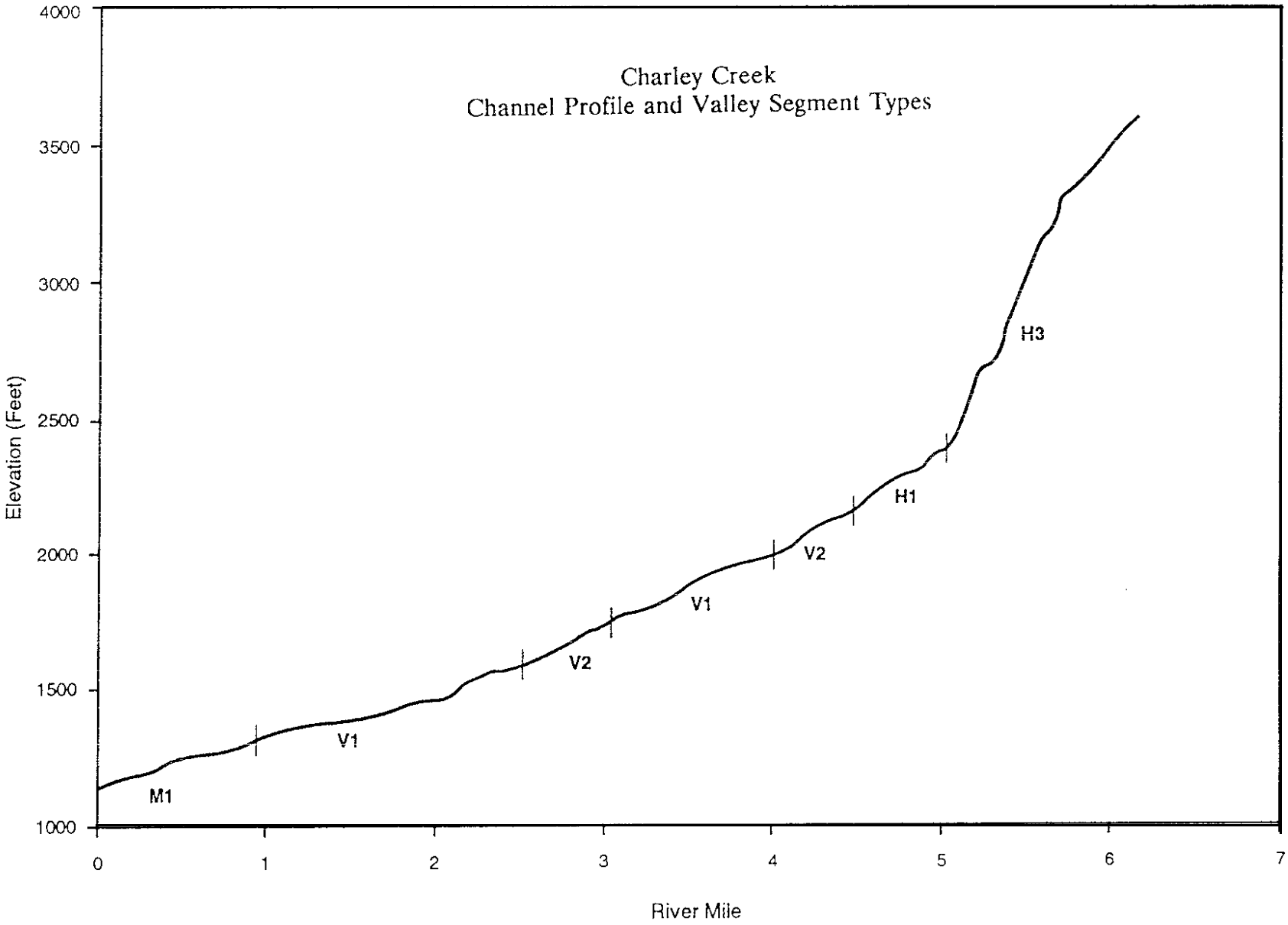

Figure 10. Charley Creek Channel Profile and Valley Segment Types.

The valley segments found in the Charley Creek watershed are typical of mountainous terrain where valley formation has been dominated by fluvial, rather than glacial, processes. Throughout its length, the channel is confined within a V-shaped valley and the valley bottom width is approximately equal to the active channel width.

An Ml. segment was delineated within the lower one mile, where sideslopes are less than 30% and the channel gradient averages 4%. For the remainder of its length, the stream is tightly confined by steep (>30%) sideslopes. The channel alternates between a moderate gradient of 3% to 4% (V1) and a relatively steep, 7% gradient (V2) between RM 1.0 and 4.4. Above RM 4.4, the small, second-order channel becomes increasingly steeper. Headwater segments, H1 and H3, were broken out based on an average channel gradient of 10% and 19%, respectively.

In order to verify valley segment types identified during the 1989 stream survey conducted by the Northwest Indian Fisheries Commission and Muckleshoot Indian Tribe, valley segments were also delineated on two second-order tributaries of Charley Creek. The stream draining from Beaverdam Lake was stratified into two valley segments: a very high gradient (14%) headwater segment (H3) from the junction with Charley Creek up to RM 0.4, and a high gradient (6%) headwater segment (H2) from RM 0.4 to the outlet of Heaverdam Lake at RM 0.9. The Lynn Lake tributary was stratified into three valley segments: a high gradient (8%), V-shaped segment (V2) from the junction with Charley Creek upstream to another tributary junction at RM 0.5, a very high gradient (22%) headwater segment (H3) from RM 0.5 to 1.9, and a moderate gradient (4%) headwater segment (H1) from RM 1.9 to 2.1.

Watershed Conditions

Vegetation

Dominant Species and Timber **Harvest** Intensity. The Vegetation Overlay displays the location of individual cells, with numbers that correspond to information about each cell in the Vegetation database. A complete listing from the Vegetation database is included in Appendix D.

As shown in Table 20, 99% of the watershed consists of forested lands, with western hemlock, true firs, and Douglas-fir being the dominant tree species. ‘To date, 74% of the watershed has been harvested.

Old-growth trees approximately 350 years old are located on 18 acres near Beaverdam Lake. There is also a remnant 7-acre patch of old-growth near the watershed divide. The remaining unharvested timber is 85 to 140 years old.

Table 21 displays the acreage of forested lands according to stand age. Timber harvest began in the watershed during the late 1940’s following what appears to have been a forest fire in the lower watershed. The most intensive period of timber removal was between 1960 and 1982. Timber sales are still occurring within the watershed and recent timber harvest has resulted in 158 acres scheduled for planting in 1990.

Table 20. Acreage Occupied by Dominant Tree Species within the Charley Creek Watershed

Dominant Species	Acres	Percent of Watershed
Douglas-fir	1,881	23%
Western hemlock	3,515	43%
True fir[1]	2,718	33%
Red alder	27	--
Western red cedar	19	--
Non-forest[2]	67	1%

[1] Includes noble fir and Pacific silver fir.

[2] Includes roads and landings, gravel pits, lakes, wetlands, a radio tower site, and powerline right-of-way.

Table 21. Stand Age for Forested Lands in the Charley Creek Watershed

Age as of 1990	Acres	Percent of Watershed
<1 year	158	2%
01 to 10	1,363	16%
11 to 20	2,680	33%
21 to 30	1,140	14%
31 to 40	277	3%
41 to 50	380	5%
51 to 90	90	1%
>90 (uncut)	2,073	25%

Note: Non-forest lands = 1% of the watershed.

Most of the harvested stands in the watershed are well-stocked. Stand densities are less than 250 on 2,675 acres, between 250 to 349 on 1,250 acres, and greater than 350 tpa on 4,236 acres. The majority of the stands with densities of less than 250 tpa are unharvested, mature timber. No commercial thinnings have been conducted in the watershed.

Riparian Condition. For most of its length, Charley Creek is confined within a narrow valley bottom bound by steep sideslopes. A distinct zone of riparian vegetation is not obvious except in the moderate slope-bound segment near the mouth. Western hemlock is the dominant species for 34% of the length of the stream corridor, Douglas-fir and true fir are dominant for another 30% respectively, and the remaining 6% is dominated by red alder.

As shown in Table 22, 37% of the length of riparian area has not been harvested. This unharvested portion of the stream corridor begins at RM 1.1 and continues unbroken to KM 2.6. Above RM 2.6, blocks of harvested units alternate with blocks of uncut forest. The RAC rating is 56 for the entire mainstem corridor.

Disturbance History

Roads. There are 44 miles of arterial, gravel-surfaced roads and 9 miles of temporary spur roads in the watershed. Road density is 4.1 miles per square mile in the 12.8square mile watershed.

There are no main haul routes or paved roads within the watershed. Because Charley Creek is within the City of Tacoma's Green River Watershed, travel is restricted.

No fillslope failures or other road-related erosion problems were observed on the aerial photos or in the field. Red alder is becoming established on many of the temporary spur roads.

Mass Wasting. The Charley Creek watershed has been remarkably stable in recent history. No recent mass wasting was evident from the aerial photos or during the field investigation. Therefore, the only item on the Miscellaneous Features Overlay is the USGS gaging station.

Fires, **Floods, and Other Disturbances.** A wildfire occurred within the watershed approximately 100-120 years ago (Mike Means, pers comm.). Evidence of the fire is visible in the mature and old-growth timber found on land managed by the Mt. Baker-Snoqualmie National Forest in Section 9 of Township 20N, Range 8E.

The largest flood in recent history in the Green River watershed was in 1977 (Mike Means, pers. comm). Unfortunately, gaging data is not available for that year. The highest flow recorded during the ten year period of record was 1,240 cfs on December 9, 1954.

A more recent flood event which affected numerous west-slope Cascade rivers occurred on November 24-25, 1990. Up to 7 inches of rain fell in the higher elevations and, combined with warm temperatures and snowmelt, resulted in flooding in the lowlands.

Table 22. Age of Riparian Vegetation Along the Mainstem of Charley Creek, as Measured from the Mouth to the Headwaters

Age as of 1990	Length of Riparian Vegetation (ft)	Percent of Riparian Area
01 to 10	6,325	20%
11 to 20	7,500	24%
21 to 30	1,375	4%
31 to 40	2,550	8%
41 to 50	2,050	6%
> 90 (uncut)	11,850	37%

Gaging data for Charley **Creek** is unavailable for this event, and damage surveys have not yet been completed by the U.S. Forest Service (Sonny Paz, pers. comm.).

Land and Water Use

Dams, Mining, Etc.. The study area is within the Green River Watershed, which serves as the water supply for the City of Tacoma. Charley Creek enters the Green River upstream of the Howard Hanson Dam, which is a barrier to anadromous fish migration. The Muckleshoot Indian Tribe plants approximately 50,000 chinook salmon *(Oncorhynchus tshawytscha)* annually at RM 0.3 of Charley Creek (Martin Fox, pers. comm.). The Washington State Department of Fisheries also plants coho salmon *(Oncorhynchus kisutch)* fingerlings at the same location.

Miscellaneous Features. Miscellaneous features in the watershed include a powerline right-of-way, gravel pits, radio tower, and numerous lakes and wetlands. The locations of these features are shown on the Vegetation Overlay.

PART 3. COMPARATIVE SUMMARY AND CONCLUSIONS

Comparison of Watershed Characteristics

The Upper Mashel River and Charley Creek watersheds lie within the western Cascade ecoregion (Omernik and Gallant, 1986). A summary of the natural characteristics of the two study areas is provided in Table 23.

While the mean elevation, basin relief, and air temperatures are remarkably similar between the two study areas, Charley Creek receives 25% more precipitation on an annual basis. The difference in precipitation may be due to the position of the watersheds relative to the path of winter storm tracks and the surrounding topography. Charley Creek is closer to both the main crest of the Cascade mountains and Puget Sound.

Due to the higher annual precipitation, Charley Creek has a higher average annual flow than the upper Mashel River, although the watershed area is smaller. Average annual runoff per square mile of the Charley Creek watershed is more than twice that of the upper Mashel River basin.

The Charley Creek watershed has a higher percentage of volcanic/intrusive geologic formations than the upper Mashel, where over one-third of the basin is underlain by sedimentary rocks. The higher percentage of more resistant parent material suggests that the Charley Creek watershed is likely to be more resistant to erosion and thus, more stable. This is indeed reflected in the disturbed soil stability ratings.

The overall land slope gradient and basin relief ratio are similar between the two study areas. Charley Creek watershed has a slightly higher percentage of land in moderate to steep slopes and a slightly higher relief ratio than the Mashel basin. If the underlying geology and soils were the same, Charley Creek would typically be considered less stable. However, although 99% of the soils in both watersheds are rated as stable in the undisturbed state, over half of the soils in the Mashel watershed are unstable when disturbed, while only one-third of the soils in Charley Creek are rated as unstable (see Appendix B for a definition of the natural and disturbed soil stability ratings). This is probably due to the higher proportion of volcanic/intrusive geologic formations in Charley Creek watershed.

The influence of geology is also reflected in the primary valley segment types found in the watersheds. In both watersheds, fluvial erosion has resulted in the formation of V-shaped valleys bounded by sleep (valley segment type V1 and V2) and moderate (Ml) slopes. However, in the Mashel River, erosion of the sedimentary material located in the upper watershed has resulted in deposition of sediment and formation of an alluvial flat within the lower valley (valley segment type V4). In Charley Creek, the sedimentary formation is located near the mouth of the watershed. The more resistant parent material underlies the basin headwaters, resulting in a slower rate of erosion and sedimentation. Aggradation has not occurred, and the stream runs at a moderate to high gradient through a tightly confined, V-shaped valley for most of its length.

Table 23. Comparison of Watershed Characteristics in the Upper Mashel River and Charley Creek Watershed

	Upper Mashel River	Charley Creek
1. Climate		
Mean elevation	2,800 feet	2,720 ft
Basin relief	3,267 feet	3,242 ft
Avg. annual precipitation	82"	103"
Avg. annual max temp.	58°F	55°F
Avg. annual min temp.	33°F	31°F
2. Geology		
Volcanic/Intrusive	65%	88%
Sedimentary	35%	11%
3. Soils		
Natural Stability	99% stable	99% stable
Disturbed Stability	47% stable	66% stable
	53% unstable	33% unstable
Average Site Index	df = 110	df = 111
	wh = 84	wh = 74
4. Hydrology		
Basin size	11,846 acres	8,227 acres
Stream order - mainstem	4	3
Drainage density	2.0 mi/mi^2	1.9 mi/mi^2
Relief ratio	0.13	0.15
Avg. annual flow	53 cfs	73 cfs
Avg. annual runoff	2.9 cfs/mi^2	6.4 cfs/mi^2
2-year flood flow	575 cfs	684 cfs
5. Geomorphology		
Slope classes:		
<30%	40	33
30% to 65%	50	54
>65%	10	13
Primary valley segments:		
	V1 - 2.9 mi	V1 2.2 mi
	v4 - 1.1 mi	V2 - 1.2 mi
	M1 1.9 mi	Ml - 1.0 mi

Overall, the Charley Creek watershed has a higher inherent stability than the upper Mashel River watershed. This conclusion is based primarily on the more resistant parent material, greater percentage of the watershed containing soils rated as stable under disturbance, and presence of valley segment types which indicate a low rate of sedimentation in the Charley Creek watershed as compared to the upper Mashel River watershed.

Comparison of Watershed Conditions

Both Charley Creek and the upper Mashel River watersheds consist primarily of forested lands dominated by western hemlock and Douglas-fir. Due to the wetter climate, there is a greater proportion of noble and Pacific silver fir in the Charley Creek watershed. As indicated by the site index, overall both watersheds have fairly good quality land for tree growth.

The primary land use in the study areas is timber production; regeneration harvest (clearcutting) has been the exclusive harvest technique. The majority of forest land in both watersheds has been clearcut. A summary of the management-affected conditions of the two watersheds is provided in Table 24.

One timber harvest rotation has been completed in the upper Mashel River basin; 100% of the watershed has been harvested. Harvest activities are ongoing in the Charley Creek watershed and currently 74% of the laud has been harvested. There are 2,163 acres of mature and old-growth timber in the central portion of this watershed.

The majority of timber removal occurred between 1960 and 1980 in both study areas. However, harvest activities are still occurring in the Charley Creek watershed, where there are 158 acres of stands scheduled for planting in 1990. Tree age in the Charley Creek watershed ranges from 0 to 350 years old. In the upper Mashel River watershed, aside from one 22-acre stand that is not established, stand age ranges from 5 to 57 years old.

The entire length of the riparian corridor of the upper Mashel River watershed has been clearcut, while 37% of the Charley Creek riparian corridor remains intact. This difference is reflected in the RAC rating of 26 for the upper Mashel River and 56 for Charley Creek. The RAC rating can also be viewed as the average age of trees within the riparian area.

Road density is 5.6 miles per square mile in the upper Mashel River watershed and 4.1 miles per square mile in Charley Creek, This difference is primarily due to the unharvested block of land in the middle of the Charley Creek watershed. Both watersheds have similar road density within the managed lands.

Analysis of the management-affected conditions of the two watersheds leads to the conclusion that the upper Mashel River watershed has been more highly impacted than the Charley Creek watershed. During field investigation and aerial photo review, ten areas of mass wasting were noted in the upper Mashel River watershed and none in Charley Creek.

Table 24. Comparison of Watershed Conditions in the Upper Mashel River and Charley Creek Watersheds

	Upper Mashel River	Charley Creek
1. Vegetation		
Dominant Species:	Western hemlock Douglas-fir	Western hemlock True fir, Douglas-fir
Age Distribution: (Percent of Watershed)		
0 to 10 years	19	18
11 to 20 years	24	33
21 to 30 years	34	14
31 to 40 years	14	3
41 to 50 years	2	5
51 to 80 years	2	0
80+	0	26
Percent of watershed clearcut	100	74
Percent of riparian area clearcut	100	63
Riparian area condition rating	26	56
2. Road Density	5.6 mi/mi^2	4.1 mi/mi^2
3. Mass wasting - number of areas	10	0

This difference in mass wasting frequency may be linked to either the lower inherent stability of the upper Mashel River watershed, the higher intensity of timber harvest, or a combination of these factors. Further study involving additional watersheds with similar characteristics and conditions is necessary before drawing additional conclusions.

Citations

Citations

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Appendix A. Climate and Hydrology

Appendix A. Climate and Hydrology

Climatic information for the two study watersheds was obtained by area-weighting the climatic data for nearby weather stations. The area-weighting was accomplished by drawing lines on the topographic maps halfway between the contours represented by the elevation of each climatic station. Each station was assumed to represent the watershed area within these lines. A weighting factor was then assigned based on the percent of the watershed area represented by each station.

The equation for the climatic data in the upper Mashel River watershed is: .92 X Rainier Longmire + .08 X Electron Headworks. The equation for Charley Creek watershed is: .27 X Cedar Lake + .61 X Snoqualmie Pass + .12 X Stampede Pass.

Tables A-l to A-5 display the summary of precipitation for the climatic stations. Snowfall depth is summarized in Tables A-6 to A-10, maximum air temperature in Tables A-11 to A-15, and minimum air temperature in Tables A-16 to A-20.

GAGING STATION SUMMARIES

Hydrologic information for Charley Creek was obtained from the USGS gaging station at RM 1.0. Table A-21 displays a summary of the daily streamflow data for the station.

Hydrologic information for the upper Mashel River was obtained by area-weighting the gaging station data for the Mashel River near La Grande. Table A-22 displays a summary of the gaging data for this station. The ratio of the watershed area of the upper watershed to the entire watershed is 0.23. Daily streamflow values were multiplied by this ratio to obtain the streamflow for the Upper Mashel subbasin.

Table A-1

Station CEDAR LAKE

Id	1233	Latitude	47:25:00	Parameter	Rain
Elevation	1560 ft	Longitude	121:44:00	Coverage	99.82%
Begin Date	1/ 1931	End Date	12/ 1986	Record Cnt	56

Summary of Precipitation, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1734	1581	1734	1678	1736	1680	1736	1736	1680	1736	1680	1734	20445
D Avg	0.44	0.38	0.34	0.26	0.19	0.18	0.08	0.09	0.19	0.30	0.45	0.48	0.28
M Cnt	56	56	56	56	56	56	56	56	56	56	56	56	56
Max M	33.35	22.16	22.88	15.17	12.87	12.09	11.17	7.75	16.71	20.57	26.10	39.49	138.31
Maxyr	1953	1961	1932	1937	1984	1942	1983	1975	1959	1947	1937	1933	1933
Min M	1.33	3.94	2.41	2.44	1.22	0.49	0.00	0.12	0.28	2.06	2.17	0.75	62.36
Minyr	1985	1941	1965	1951	1958	1965	1958	1967	1975	1952	1936	1985	1952
Avg M	13.52	10.60	10.50	7.89	6.00	5.31	2.47	2.79	5.67	9.39	13.51	14.78	102.43
M Std	6.37	4.26	3.87	3.06	2.67	2.87	1.98	2.00	3.36	4.28	5.55	5.46	17.37
M Skw	0.40	0.43	0.58	0.26	0.82	0.36	1.72	0.99	1.03	0.47	0.19	1.31	0.04
M Kur	3.15	2.55	3.87	2.56	3.05	2.32	7.75	2.71	3.96	2.81	2.37	8.81	2.44

Table A-Z

Station ELECTRON HEADWORKS

Id	2493	Latitude	46:54:00	Parameter	Rain
Elevation	1730 ft	Longitude	122:02:00	Coverage	96.8 %
Begin Date	6/1948	End Date	5/ 1980	Record Cnt	33

Summary of Precipitation, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	992	904	991	960	992	960	991	992	960	992	960	988	11682
D Avg	0.32	0.25	0.20	0.17	0.13	0.11	0.05	0.07	0.11	0.21	0.29	0.33	cl.19
M Cnt	32	32	32	32	32	32	32	32	32	32	32	32	31
Max M	20.84	16.74	10.24	8.76	10.04	6.93	4.28	6.59	7.65	12.68	19.01	17.61	88.33
Maxyr	1953	1961	1956	1958	1960	1954	1948	1968	1959	1955	1958	1953	1959
Min M	1.26	2.32	0.81	1.00	1.65	0.77	0.04	0.02	0.37	1.31	1.70	2.18	38.16
Minyr	1949	,962	1965	1951	1980	1965	1960	1967	1975	1952	1952	1976	1952
Avg M	9.78	7.00	6.08	5.10	3.91	3.34	1.40	2.19	3.34	6.46	8.83	10.27	61.46
M Std	5.55	3.34	2.23	2.12	1.69	1.59	1.06	1.73	1.61	3.09	3.83	3.52	12.30
M Skw	0.41	0.91	6.21	-0.01	1.67	0 40	0.86	0.86	0.32	0.35	0.54	6.03	4.44
M Kur	1.99	3.52	2.33	1.81	6.20	2 49	2.89	2.60	2.96	2.31	3.34	2.45	2.63

Table A-3

Station RAINIER LONGMIRE

Id	6894	Latitude	46:45:00	Parameter	Rain
Elevation	2760 ft	Longitude	121:49:00	Coverage	98.9 %
Begin Date	1/ 1931	End Date	11/ 1978	Record Cnt	48

Summary of Precipitation, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1467	1344	1474	1432	1486	1436	1487	1488	1438	1479	1424	1416	17371
D Avg	0.41	0.32	0.26	0.18	0.13	0.12	0.04	0.07	0.14	0.26	0.38	0.45	0.23
M Cnt	48	48	48	48	48	48	48	48	48	48	48	46	46
Max M	26.83	19.29	16.91	11.65	10.36	7.43	4.13	8.36	13.36	17.49	21.99	36.09	113.60
Maxyr	1953	1961	1932	1937	1960	1968	1955	1968	1959	1967	1932	1933	1933
Min M	2.35	2.29	1.35	0.97	1.05	0.49	0.00	0.08	0.08	1.52	0.78	5.26	43.22
Minyr	1977	1941	1965	1951	1935	1951	1931	1967	1942	1972	1936	1944	1952
Avg M	12.43	8.88	8.05	5.22	4.00	3.60	1.38	2.18	4.08	7.88	11.38	13.71	82.50
M Std	6.53	3.97	3.31	2.41	1.84	1.89	1.08	1.97	2.65	4.00	5.09	5.68	15.52
M Skw	0.50	0.40	0.32	0.38	1.39	0.22	0.67	1.32	1.05	0.53	0.17	1.46	-0.24
M Kur	2.18	2.75	2.69	2.51	5.27	2.30	2.59	3.70	4.24	2.61	2.32	6.40	2.34

Table A-4

Station SNOQUALMIE PASS

Id	7781	Latitude	47:25:00	Parameter	Rain
Elevation	3020 ft	Longitude	121:25:00	Coverage	89.3 %
Begin Date	1/ 1931	End Date	2/ 1972	Record Cnt	42

Summary of Precipitation, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1231	1110	1195	1129	1149	1122	1145	1092	1073	1131	1141	1201	13719
D Avg	0.52	0.43	0.36	0.21	0.14	0.13	0.05	0.07	0.17	0.32	0.50	0.57	0.29
M Cnt	40	39	39	38	37	38	36	35	36	35	38	39	31
Max M	40.00	23.90	23.07	14.78	11.05	16.67	4.78	5.85	18.05	19.85	30.61	44.60	144.74
Maxyr	1953	1961	1932	1937	1936	1937	1955	1968	1959	1967	1932	1933	1933
Min M	4.23	3.74	1.80	1.14	0.36	0.00	0.05	0.00	0.44	1.83	2.82	7.64	77.23
Minyr	1942	1962	1965	1951	1945	1965	1967	1967	1966	1936	1952	1944	1965
Avg M	15.91	12.39	11.11	6.39	4.19	3.97	1.58	2.20	4.74	9.73	14.94	17.45	105.43
M Std	7.84	4.83	4.95	3.06	2.48	3.09	1.19	1.59	3.63	4.57	6.68	6.59	20.66
M Skw	0.68	0.08	0.22	0.50	0.96	2.10	0.56	0.73	1.67	0.58	0.60	1.59	0.47
M Kur	3.27	2.38	2.43	2.77	3.49	8.32	2.56	2.39	5.89	2.56	2.77	8.04	1.86

Table A-5

Station STAMPEDE PASS WSCMO AP

Id	8009	Latitude	47:17:00	Parameter	Rain
Elevation	3960 ft	Longitude	121:20:00	Coverage	99.6 %
Begin Date	1/ 1944	End Date	12/ 1986	Record Cnt	43

Summary of Precipitation, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1330	1215	1328	1290	1333	1290	1333	1333	1289	1332	1289	1302	15664
D Avg	0.44	0.36	0.28	0.21	0.13	0.13	0.05	0.08	0.16	0.26	0.41	0.46	0.25
M Cnt	43	43	43	43	43	43	43	43	43	43	43	42	42
Max M	30.42	20.78	19.54	12.50	9.12	7.98	5.96	7.17	15.24	23.55	25.43	29.06	124.10
Maxyr	1969	1961	1955	1970	1960	1947	1983	1975	1959	1967	1958	1953	1975
Min M	0.97	1.36	2.56	1.12	0.98	0.37	0.19	0.36	0.37	1.33	0.93	1.73	48.40
Minyr	1985	1973	1965	1951	1958	1965	1960	1955	1975	198"	1952	1985	1952
Avg M	13.45	10.22	8.60	6.26	4.05	3.9'1	1.70	2.50	4.79	8.05	12.35	14.41	90.22
M Std	7.71	4.30	3.44	2.83	1.80	1.93	1.21	1.90	2.86	4.73	5.32	6.58	17.87
M Skw	0.46	0.51	0.87	0.33	0.90	0.2%	1.16	1.07	1.21	0.97	0.18	0.X	-0.05
M Kur	2.15	3.24	3.71	2.15	3.42	2.08	4.72	2.79	5.04	3.86	2.69	2.53	2.19

Table A-6

Station CEDAR LAKE

Id	1233	Latitude	47:25:00	Parameter	Snow
Elevation	1560 ft	Longitude	121:44:00	Coverage	99.6%
Begin Date	1/ 1931	End Date	12/ 1986	Record Cnt	56

Summary of snowfall, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1732	1564	1729	1676	1736	1680	1736	1736	1680	1735	,675	1729	20408
D Avg	0.68	0.54	0.44	0.13	0.01	0.00	0.00	0.00	0.00	0.02	0.18	0.47	0.20
M Cnt	56	56	56	56	56	56	56	56	56	56	56	56	56
Max M	93.00	64.50	51.50	26.90	5.50	0.00	0.00	0.00	0.00	19.00	30.20	72.50	156.70
Maxyr	1950	,949	1951	1972	1955	1952	1952	1986	1950	1935	1985	1948	1948
Min M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.70
Minyr	1981	,981	1986	1962	1986	1986	1986	,986	1986	1986	1983	1985	1941
Avg M	21.18	15.31	13.47	3.80	0.34	0.00	0.00	0.00	0.00	0.55	5.26	14.36	74.17
M Std	21.21	15.74	12.85	6.01	0.97					2.64	7.36	15.65	41.90
M Skw	1.41	1.21	1.22	2.12	3.85					6.54	1.60	1.53	0.40
M Kur	4.66	3.69	3.70	6.62	17.24					42.65	4.56	4.89	2.05

Table A-'7

Station ELECTRON HEADWORKS

Id	2493	Latitude	46:54:00	Parameter	Snow
Elevation	1730 ft	Longitude	122:02:00	Coverage	96 %
Begin Date	6/ 1948	End Date	5/ 1980	Record Cnt	33

Summary of Snowfall, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	992	W I	961	959	992	960	992	992	960	992	955	957	11613
D Avg	0.50	0.31	0.35	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.09	0.28	0.13
M Cnt	32	32	31	32	32	32	32	32	32	32	32	31	29
Max M	84.30	47.90	42.10	9.90	1.00	0.00	0.03	0.00	0.00	1.80	17.90	28.40	105.60
Maxyr	1950	1949	1955	1955	1968	1949	1979	,979	,979	1971	1975	1971	1950
Min M	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	13.00
Minyr	1961	1960	1969	1974	1980	1979	1979	,979	1979	1979	1971	1979	1959
Avg M	15.40	8.49	10.98	2.05	0.05	0.00	0.00	0.00	0.00	0.14	2.58	8.73	50.60
M Std	16.92	10.51	10.63	2.67	0.20					0.42	4.33	7.58	25.23
M Skw	2.40	2.37	1.57	1.89	4.43					3.15	2.46	1.19	0.50
M Kur	9.05	7.83	4.12	5.23	18.72					10.17	7.51	3.58	2.08

Table A-8

Station RAINIER LONGMIRE

Id	6894	Latitude	46:45:00	Parameter	Snow
Elevation	2760 ft	Longitude	121:49:00	Coverage	98.9 %
Begin Date	1/ 1931	End Date	11/ 1978	Record Cnt	48

Summary of Snowfall, in inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1466	1345	1473	1432	1486	1437	1488	1488	,438	1480	147.1	1417	17371
D Avg	1.69	1.34	1.09	0.35	0.04	0.00	0.00	0.03	0.00	0.05	0.50	1.32	0.52
M Cnt	48	48	48	48	48	48	48	48	48	48	48	46	46
Max M	151.50	123.w	131.50	48.20	8.50	0.50	0.00	0.00	1.50	12.00	70.03	203.00	382.30
Maxyr	1950	1949	1955	1955	1974	1954	1978	1978	1972	1946	1945	1949	1955
Min M	1.00	0.0	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	2.00	38.20
Minyr	1961	1934	1934	1958	1976	1978	1978	1978	1978	,917	1952	1939	1941
Avg M	51.48	36.86	33.23	10.48	1.10	0.01	0.00	0.00	0.03	1.51	14.89	40.66	191.41
M Std	37.62	27.95	26.52	11.42	2.1%	0.07			0.22	3.07	17.09	36.11	84.03
M Skw	0.75	1.16	1.44	1.64	2.3"	6.93			6.93	2.26	1.51	2.33	0.40
M Kur	2.75	4.33	5.46	5.17	6.86	41.12			41.12	6.49	4.39	9.85	2.56

Table A-9

Station SNOQUALMIE PASS

Id	7781	Latitude	47:25:00	Parameter	Snow
Elevation	3020 ft	Longitude	121:25:00	Coverage	87.7 %
Begin Date 1/ 1931		End Date 2/ 1972		Record Cnt 42	

Summary of Snowfall, in Inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1199	1088	1150	1136	1151	1127	1145	1096	1104	1108	1041	1128	13473
D Avg	3.48	2.86	2.54	0.91	0.16	0.00	0.00	0.00	0.01	0.21	1.45	3.02	1.23
M Cnt	39	38	37	38	37	38	36	35	37	35	34	37	26
Max M	265.00	190.50	222.00	87.40	30.30	2.00	3.00	0.00	5.00	44.00	114.00	196.70	799.50
Maxyr	1964	1937	1955	1955	1943	1933	1955	1970	1933	1956	1948	1968	1964
Min M	24.50	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.00	167.10
Minyr	1945	1943	1941	1951	1962	1970	1970	1970	1970	1969	1933	1958	1941
Avg M	106.92	81.31	77.09	27.15	4.99	0.11	0.08	0.00	0.24	6.58	42.97	92.08	431.44
M Std	63.07	43.92	47.97	23.02	6.47	0.39	0.50		1.04	9.54	29.93	45.16	160.56
M Skw	1.02	0.32	0.74	0.98	2.04	3.99	6.00		4.20	2.31	0.62	0.28	0.61
M Kur	3.36	2.58	3.28	2.89	7.18	16.41	32.16		16.54	7.89	2.68	2.06	2.63

Table A-10

Station STAMPEDE PASS WSCMO AP

Id	8009	Latitude	47:17:00	Parameter	Snow
Elevation	3960 ft	Longitude	121:20:00	Coverage	99.6 %
Begin Date	1/ 1944	End Date	12/ 1986	Record Cnt	43

Summary of Snowfall, in Inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Da:	Annual
D Cnt	1330	1215	1328	1290	1333	1290	1333	1333	,289	1332	1290	1302	15665
D Avg	2.81	2.52	2.16	1.43	0.46	0.05	0.01	0.00	0.05	0.61	2.13	2.56	1.22
M Cnt	43	43	43	43	43	43	43	43	43	43	43	42	42
Max M	230.10	181.70	154.80	107.20	45.90	9.10	6.40	0.00	26.70	65.40	138.50	163.30	685.10
Maxyr	1972	1949	1955	1970	1984	1954	1971	1964	1972	1984	1945	1949	1970
Min M	7.40	9.10	23.70	1.80	0.00	0.00	0.03	0.00	0.03	0.00	5.80	17.M	277.50
Minyr	1985	1973	1965	1951	,957	1986	1986	1986	1981	1986	,952	1985	1952
Avg M	86.96	70.61	66.58	42.98	14.3"	1.38	0.38	0.03	1.59	18.95	64.00	79.2,	445.52
M Std	51.66	35.53	29.04	23.65	11.52	2.42	1.35		4.31	15.04	34.91	36.4,	110.00
M Skw	0.91	0.79	0.68	0.68	0.84	2.16	3.88		5.01	1.00	0.25	0.66	0.44
M Kur	3.21	3.80	3.14	2.51	3.04	6.11	15.25		26.98	3.69	2.05	2.39	2.03

Table A-11

Station CEDAR LAKE

Id	1233	Latitude	47:25:00	Parameter	T Max
Elevation	1560 ft	Longitude	121:44:00	Coverage	99.67%
Begin Date	1/ 1931	End Date	12/ 1986	Record Cnt	56

Summary of Maximum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	APr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1728	1580	1736	1680	1736	1680	1730	1728	1676	1735	1677	1729	20415
D Avg	40	44	47	53	60	65	71	71	66	58	47	41	55
M Cnt	56	56	56	56	56	56	56	56	56	56	56	56	56
Max M	48	52	58	62	70	71	82	82	75	67	56	47	60
Maxyr	1981	1963	1941	1951	1958	1961	1985	1967	1974	1952	1949	1958	1958
Min M	26	34	39	48	53	59	64	64	60	51	36	33	52
Minyr	1950	1936	1955	1955	1962	1971	1955	1948	1941	1946	1985	1983	1955
M Std	4	4	4	4	3	3	4	4	3	3	4	3	1

Table A-12

Station ELECTRON HEADWORKS

Id	2493	Latitude	46:54:00	Parameter	T Max
Elevation	1730 ft	Longitude	122:02:00	Coverage	96.7 %
Begin Date	6/ 1948	End Date	5/ 1980	Record Cnt	33

Summary of Maximum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	991	903	991	960	990	960	990	989	957	990	959	988	11668
D Avg	39	44	48	54	62	68	74	72	67	57	46	41	56
M Cnt	32	32	32	32	32	32	32	32	32	32	32	32	31
Max M	48	53	53	61	71	73	82	82	74	67	51	49	61
Maxyr	1961	1963	1979	1951	1958	1970	1958	1967	1957	1952	1949	1958	1958
Min M	29	38	42	48	55	60	66	65	61	52	41	36	52
Minyr	1950	1956	1955	1955	1962	1953	1955	1954	1978	1975	,973	1978	1955
M Std	4	3	3	3	4	4	4	4	4	3	3	3	1

Table A-13

Station RAINIER LONGMIRE

Id	6894	Latitude	46:45:00	Parameter	T Max
Elevation	2760 ft	Longitude	121:49:00	Coverage	97.9 %
Begin Date	1/ 1931	End Date	11/ 1978	Record Cnt	48

Summary of Maximum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1457	1330	1454	1416	1470	1427	1476	1477	1417	1453	1406	1406	17189
D Avg	36	40	44	52	61	66	75	74	68	57	44	38	55
M Cnt	48	48	48	48	48	48	48	48	48	48	48	46	46
Max M	44	50	58	62	71	76	83	85	78	70	56	45	58
Maxyr	1961	1941	1941	1934	1958	1961	1958	1967	1967	1952	1936	1935	1934
Min M	26	31	35	41	51	59	66	66	58	50	36	33	50
Minyr	1950	1933	1955	1955	1933	1953	1955	1976	1978	1975	1973	1951	1955
M Std	3	4	4	4	5	4	4	4	5	4	4	3	2

Table A-14

Station SNOQUALMIE PASS

Id	7781	Latitude	47:25:00	Parameter	T Max
Elevation	3020 ft	Longitude	121:25:00	Coverage	86.0 %
Begin Date	1/1931	End Date	2/ 1972	Record Cnt	42

Summary of Maximum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1155	1075	1149	1057	1103	1097	1108	1037	1062	1098	1105	1167	13213
D Avg	32	37	42	49	57	63	70	69	64	54	40	33	51
M Cnt	37	37	36	34	34	37	36	32	35	36	37	38	26
Max M	38	46	52	59	68	72	78	80	74	65	47	38	54
Maxyr	1953	1963	1941	1934	1958	1961	1938	1967	1938	1952	1949	1957	1958
Min M	24	23	36	43	49	55	63	63	55	47	34	28	48
Minyr	1969	1936	1933	1970	1962	1953	1932	1954	1941	1950	1955	1968	1932
M Std	4	4	3	4	4	4	4	4	5	4	3	3	1

Table A-15

Station STAMPEDE PASS WSCMO AP

Id	8009	Latitude	47:17:00	Parameter	T Max
Elevation	3960 ft	Longitude	121:20:00	Coverage	99.6 %
Begin Date	1/1944	End Date	12/ 1986	Record Cnt	43

Summary of Maximum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1329	1215	1328	1290	1333	1290	1333	1333	1289	1332	1289	1302	15663
D Avg	28	32	35	41	50	57	65	64	58	47	34	30	45
M Cnt	43	43	43	43	43	43	43	43	43	43	43	42	42
Max M	36	41	42	49	60	65	74	75	66	58	44	37	49
Maxyr	1953	1963	1947	1977	1958	1961	1985	1967	1957	1952	1949	1980	1958
Min M	15	25	28	35	43	50	58	57	51	42	24	22	42
Minyr	1950	1956	1955	1970	1955	1953	1986	1954	1978	1975	1985	1983	1955
M Std	4	3	3	4	4	4	4	4	4	4	3	4	1

Table A-16

Station CEDAR LAKE

Id	1233	Latitude	47:25:00	Parameter	T Min
Elevation	1560 ft	Longitude	121:44:00	Coverage	99.6%
Begin Date	1/ 1931	End Date	12/ 1986	Record Cnt	56

Summary of Minimum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1730	1578	1734	1677	1735	1679	1734	1734	1680	1731	,676	1733	20421
D Avg	30	32	33	36	41	46	50	50	47	41	36	32	39
M Cnt	56	56	56	56	56	56	56	56	56	56	56	56	56
Max M	39	38	40	43	46	51	54	54	52	47	42	38	43
Maxyr	1981	1963	1941	1934	1958	1969	1941	1933	1938	1937	1949	1939	1934
Min M	13	21	26	31	36	42	45	42	43	36	25	24	35
Minyr	1950	1936	1951	1975	1950	1976	1951	1951	,972	1949	1985	1983	1951
M Std	5	4	3	2	2	2	2	2	2	3	3	3	2

Table A-17

Station ELECTRON HEADWORKS

Id	2493	Latitude	46:54:00	Parameter	T Min
Elevation	1730 ft	Longitude	122:02:00	Coverage	96 %
Begin Date	6/ 1948	End Date	5/ 1980	Record Cnt	33

Summary of Minimum Temperatures, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	991	903	991	959	989	955	990	989	957	990	959	988	11661
D Avg	28	30	31	33	38	44	46	46	42	37	32	30	36
M Cnt	32	32	32	32	32	32	32	32	32	32	32	32	31
Max M	35	36	35	39	42	50	50	49	46	40	37	36	39
Maxyr	1953	1958	1980	1980	1957	1969	1975	1977	1963	1963	1949	1958	1958
Min M	15	26	25	30	35	40	43	41	38	33	26	24	35
Minyr	1950	1949	1955	1955	1950	1949	1952	1951	1961	1972	1952	1978	1951
M Std	5	2	2	2	2	2	1	2	2	2	3	3	1

Appendix B. Slope 'Data Base

The slope data was obtained from the Slope overlays constructed for the Charley Creek and upper Mashel River watersheds. Cells on the slope overlay contain a 4-digit number, of which the first digit is the slope class and the remaining three digits the unique cell identification number. The minimum size of the areas delineated is 5 acres. The following key explains the information in the Slope database.

WRIA#:	Water Resource Inventory Area number
WATERSHED:	Name of subwatershed
SLOPE:	Slope class determined from USGS topographic map where, 1 = 0% to 5% 2 = 5% to 30% 3 = 30% to 65% 4 = 65% to 90% 5 = >90%
CELL:	Three digit cell identification number
ACRES:	Measured size of area, in acres

Table A-19

Station SNOQUALMIE**PASS**

Id	7781	Latitude	47:25:00	Parameter	T Min
Elevation	3020 ft	Longitude	121:25:00	Coverage	85.7 %
Begin Date	1/1931	End Date	2/1972	Record Cnt	42

Summary of Minimum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1163	1076	1157	1064	1081	1083	1091	1036	1063	1098	1082	1171	13165
D Avg	21	23	26	30	35	40	46	46	42	35	28	24	33
M Cnt	38	38	36	34	35	36	34	32	36	35	36	38	27
Max M	30	30	30	35	38	46	51	50	46	40	33	29	36
Maxyr	1953	1958	1968	1934	1957	1969	1942	1942	1963	1944	1965	1966	1941
Min M	5	8	19	26	32	34	42	43	37	29	20	17	30
Minyr	1949	1936	1954	1935	1964	1946	1933	1964	1948	1946	1955	1968	1955
M Std	6	4	2	2	2	3	2	2	2	2	3	3	

Table A-20

Station STAMPEDE PASS WSCMO AP

Id	8009	Latitude	47:17:00	Parameter	T Min
Elevation	3960 ft	Longitude	121:20:00	Coverage	99.6 %
Begin Date	1/1944	End Date	12/1986	Record Cnt	43

Summary of Minimum Temperature, in degrees Fahrenheit

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
D Cnt	1329	1215	1328	1290	1333	1290	1333	1333	1289	1332	1289	1302	15663
D Avg	20	24	26	29	36	41	47	47	43	36	27	22	33
M Cnt	43	43	43	43	43	43	43	43	43	43	43	42	42
Max M	28	31	31	34	42	49	52	54	48	42	33	29	36
Maxyr	1953	1963	1983	1977	1958	1969	1958	1967	1974	1944	1949	1980	1958
Min M	3	16	19	25	30	37	43	43	39	31	15	13	30
Minyr	1950	1956	1955	1955	1955	1954	1986	1975	1961	1946	1985	1983	1955
M Std	5	3	3	2	3	3	2	3	3	3	3	4	1

Table A-21

CHARLEY CREEK
Daily Streamflow summary

USGS Ga 12105500 Period of record 1947 - 1956
Latitude 47:15:00 Longitude 121:47:00
Drainage Area 11.3 mi2

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Cnt	310	300	279	279	254	279	270	279	270	279	279	270	3348
D Avg	54	96	111	94	109	68	98	97	77	34	22	20	73
D Max	411	515	1240	678	971	556	317	299	328	177	99	117	1240
D Min	7	7	7	16	21	21	40	22	19	13	11	10	7
M Cnt	10	10	9	9	9	9	9	9	9	9	9	9	9
M Std	29	44	63	52	32	29	16	33	44	16	9	9	12
M Skw	0	0	1	2	1	2	0	-1	1	1	1	1	0
M Max	94	156	223	211	179	139	125	131	153	70	36	35	90
M Min	10	9	19	37	77	37	76	35	30	15	12	11	56

Q2 = 684

Table A-22

MASHEL RIVER NEAR LA GRANDE , WASH.
Daily Streamflow summary

USGS Gage ID 12087000 Year 1941 - 1957
Latitude 46:51:25 Longitude 122:18:05 Gage Datum 619.53
Drainage Area 81mi2 Hydrologic Unit 17110015

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
D Cnt	527	510	527	527	480	527	510	527	510	527	527	510	6209
D Avg	129	326	439	356	408	312	299	226	168	61	28	43	232
D Max	1160	2740	5570	2870	2630	2170	1040	1260	1120	522	144	458	5570
D Min	7	8	14	30	26	45	45	29	21	7	9	7	7
M Cnt	17	17	17	17	17	17	17	17	17	17	17	17	17
M Std	80	183	223	179	162	147	94	101	92	44	16	32	59
M Skw	0	0	0	0	0	1	0		0		2		0
M Max	307	688	890	694	703	567	475	441	329	173	71	115	337
M Min	10	13	83	113	99	88	132	67	53	15	13	11	125

Appendix B. Slope Database

Appendix B. Slope 'Data Base

The slope data was obtained from the Slope overlays constructed for the Charley Creek and upper Mashel River watersheds. Cells on the slope overlay contain a 4-digit number, of which the first digit is the slope class and the remaining three digits the unique cell identification number. The minimum size of the areas delineated is 5 acres. The following key explains the information in the Slope database.

WRIA#:	Water Resource Inventory Area number
WATERSHED:	Name of subwatershed
SLOPE:	Slope class determined from USGS topographic map where, 1 = 0% to 5% 2 = 5% to 30% 3 = 30% to 65% 4 = 65% to 90% 5 = >90%
CELL:	Three digit cell identification number
ACRES:	Measured size of area, in acres

SLOPE CLASS SUMMARY

WRIA#	Watershed	Slope	Cell	Acres
9	Charley	1	1	5
9	Charley	1	2	1
9	Charley	1	3	10
9	Charley	1	4	2
	Total Acres in Slope Class 1:			18
9	Charley	2	1	11
9	Charley	2	2	15
9	Charley	2	3	99
9	Charley	2	4	3
9	Charley	2	5	11
9	Charley	2	6	11
9	Charley	2	7	63
9	Charley	2	8	18
9	Charley	2	9	1199
9	Charley	2	10	158
9	Charley	2	11	72
9	Charley	2	12	64
9	Charley	2	13	9
9	Charley	2	14	11
9	Charley	2	15	12
9	Charley	2	16	20
9	Charley	2	17	23
9	Charley	2	18	8
9	Charley	2	19	177
9	Charley	2	20	27
9	Charley	2	21	7
9	Charley	2	22	8
9	Charley	2	23	10
9	Charley	2	24	9
9	Charley	2	25	17
9	Charley	2	26	7
9	Charley	2	27	6
9	Charley	2	28	130
9	Charley	2	29	40
9	Charley	2	30	13
9	Charley	2	31	36
9	Charley	2	32	5

WRIA#	Watershed	Slope	Cell	Acres
9	Charley	2	33	13
9	Charley	2	34	25
9	Charley	2	35	20
9	Charley	2	36	65
9	Charley	2	37	18
9	Charley	2	38	2
9	Charley	2	39	260
		Total Acres in Slope Class 2:		2702
9	Charley	3	1	5
9	Charley	3	2	3
9	Charley	3	3	44
9	Charley	3	4	3
9	Charley	3	5	3
9	Charley	3	6	906
9	Charley	3	7	3124
9	Charley	3	8	96
9	Charley	3	9	7
9	Charley	3	10	16
9	Charley	3	11	14
9	Charley	3	12	47
9	Charley	3	13	14
9	Charley	3	14	7
9	Charley	3	15	10
9	Charley	3	16	197
9	Charley	3	17	7
		Total Acres in Slope Class 3:		4503
9	Charley	4	1	5
9	Charley	4	2	3
9	Charley	4	3	4
9	Charley	4	5	5
9	Charley	4	6	3
9	Charley	4	7	3
9	Charley	4	8	14
9	Charley	4	9	5
9	Charley	4	10	17
9	Charley	4	11	42
9	Charley	4	12	3
9	Charley	4	13	14

WRIA#	Watershed	Slope	Cell	Acres
9	Charley	4	14	4
9	Charley	4	15	31
9	Charley	4	16	4
9	Charley	4	17	11
9	Charley	4	18	3
9	Charley	4	19	13
9	Charley	4	20	620
9	Charley	4	21	15
9	Charley	4	22	16
9	Charley	4	23	12
9	Charley	4	24	14
9	Charley	4	25	26
9	Charley	4	26	3
9	Charley	4	27	41
9	Charley	4	28	30
9	Charley	4	29	6
9	Charley	4	30	7
9	Charley	4	31	4
9	Charley	4	32	7
		Total Acres in Slope Class 4:		985
9	Charley	5	1	5
9	Charley	5	2	6
9	Charley	5	3	5
9	Charley	5	4	3
		Total Acres in Slope Class 5:		19
		Total Acres in Watershed:		8227
11	Mashel	1	1	6
11	Mashel	1	2	4
11	Mashel	1	3	63
11	Mashel	1	4	9
11	Mashel	2	1	526
11	Mashel	2	2	100
11	Mashel	2	3	434
11	Mashel	2	4	24
11	Mashel	2	5	11
11	Mashel	2	6	36
11	Mashel	2	7	25

WRIA#	Watershed	Slope	Cell	Acres
11	Mashel	2	8	57
11	Mashel	2	9	31
11	Mashel	2	10	19
11	Mashel	2	11	66
11	Mashel	2	12	13
11	Mashel	2	13	203
11	Mashel	2	14	12
11	Mashel	2	15	17
11	Mashel	2	16	180
11	Mashel	2	17	144
11	Mashel	2	18	20
11	Mashel	2	19	30
11	Mashel	2	20	7
11	Mashel	2	21	599
11	Mashel	1	22	263
11	Mashel	2	23	462
11	Mashel	2	24	4
11	Mashel	2	25	305
11	Mashel	2	26	330
11	Mashel	2	27	325
11	Mashel	2	28	232
11	Mashel	2	29	21
11	Mashel	2	30	66
11	Mashel	2	31	18
11	Mashel	2	32	154
11	Mashel	2	33	20
11	Mashel	2	34	6
11	Mashel	2	35	15
11	Mashel	2	36	23
11	Mashel	2	37	5
11	Mashel	2	38	21
11	Mashel	2	39	15
11	Mashel	2	40	72
11	Mashel	2	41	20
11	Mashel	2	42	32
		Total Acres in Slope Class 2:		4763
11	Mashel	3	1	92
11	Mashel	3	2	29
11	Mashel	3	3	57

WRIA#	Watershed	Slope	Cell	Acres
11	Mashel	3	4	50
11	Mashel	3	5	2250
11	Mashel	3	6	15
11	Mashel	3	7	40
11	Mashel	3	8	438
11	Mashel	3	9	1120
11	Mashel	3	10	21
11	Mashel	3	11	1280
11	Mashel	3	12	12
11	Mashel	3	13	28
11	Mashel	3	14	40
11	Mashel	3	15	66
11	Mashel	3	16	35
11	Mashel	3	17	14
11	Mashel	3	18	1.5
11	Mashel	3	19	41
11	Mashel	1	320	5
11	Mashel	3	21	85
11	Mashel	3	22	33
11	Mashel	3	23	40
11	Mashel	3	24	5
		Total Acres in Slope Class 3:		5911
11	Mashel	4	1	74
11	Mashel	4	2	20
11	Mashel	4	3	17
11	Mashel	4	4	3
11	Mashel	4	5	18
11	Mashel	4	6	9
11	Mashel	4	7	10
11	Mashel	4	8	5
11	Mashel	4	9	23
11	Mashel	4	10	13
11	Mashel	4	11	44
11	Mashel	4	12	33
11	Mashel	4	13	J
11	Mashel	4	14	6
11	Mashel	4	1.5	J
11	Mashel	4	16	14
11	Mashel	4	17	11
11	Mashel	4	18	264

WRIA#	Watershed	Slope	Cell	Acres
11	Mashel	4	19	14
11	Mashel	4	20	6
11	Mashel	4	21	29
11	Mashel	4	22	4
11	Mashel	4	23	89
11	Mashel	4	24	51
11	Mashel	4	25	4
11	Mashel	4	26	17
11	Mashel	4	27	3
11	Mashel	4	28	82
11	Mashel	4	29	6
11	Mashel	4	30	15
11	Mashel	4	31	11
11	Mashel	4	32	19
11	Mashel	4	33	142
11	Mashel	4	34	9
		‘Total Acres in Slope Class 4:		1079
11	Mashel	5	1	6
11	Mashel	5		2
11	Mashel	5	3	4
		Total Acres in Slope Class 5:		11
		‘Total Acres in Watershed:		11846

CHANNEL PROFILES

The channel profiles were constructed by following the mainstem channel of each watershed and measuring the distance between contour lines. Tables B-1 and B-2 display the channel profile data for the upper Mashel River and Charley Creek, respectively.

Table B-l. Channel Profile of the Mainstem Mashel River Above Busy Wild Creek

Elevation	Increment feet	Total feet	River mile	Elevation	Increment feet	Total feet	River mile	Elevation	Increment feet	Total feet	River mile
1610	0	0	0.00	40	375	37.5	6.34	1240	100	4050	7.04
1640	125	125	0.02	80	375	750	6.42	1280	100	4150	7.06
1680	2500	2625	0.50	120	375	1125	6.49	1320	100	4250	7.08
1720	500	3125	0.59	160	375	1500	6.56	1360	100	4350	7.10
1760	750	3875	0.73	200	250	1750	6.61	1400	100	4450	7.12
1800	2500	6315	1.21	240	250	2000	6.65	1440	125	4575	7.14
1840	1500	7875	1.49	280	125	2125	6.68	1480	500	5075	7.23
1880	1000	8875	1.68	320	125	2250	6.70	1520	125	5200	7.26
1920	1500	10375	1.96	360	125	2375	6.72				
1960	1125	11500	2.18	400	125	2500	6.75				
2000	1125	12625	2.39	440	125	2625	6.77				
2040	1250	13875	2.63	480	125	2750	6.19				
2oso	1750	15625	2.96	520	125	2875	6.82				
2120	1375	17000	3.22	560	100	2975	6.84				
2160	500	17500	3.31	600	100	3075	6.86				
2200	1500	19000	3.60	640	100	3175	6.88				
2240	1000	20000	3.79	680	100	3275	6.89				
2280	625	20625	3.91	720	100	3375	6.91				
2320	1750	22375	4.24	760	100	3475	6.93				
2360	1000	23375	4.43	800	100	3575	6.95				
2400	1750	25125	4.76	840	50	3625	6.96				
2440	1500	26625	5.04	880	50	3675	6.97				
2480	1000	27625	5.23	920	50	3725	6.98				
2520	1000	28625	5.42	960	so	3775	6.99				
2560	750	29375	5.56	1000	so	3825	7.00				
2600	1000	30375	5.75	1040	25	38.50	7.00				
2640	750	31125	5.89	1080	25	3875	7.01				
2680	500	31625	5.99	1120	25	3900	7.01				
2720	500	32125	6.08	1160	25	3925	7.M				
2760	500	32625	6.18	1200	25	3950	7.02				

Table B-2. Channel Profile of the Mainstem of Charley Creek

Elevation	Increment feet	Total feet	River mile	Elevation	Increment feet	Total feet	River mile
1140	0	0	0	2440	250	26803	5.1
1160	500	500	0.1	2480	125	26925	5.1
1200	1250	1750	0.3	2520	125	27050	5.1
1240	750	25.x	0.5	2560	125	27175	5.1
1280	1500	4000	0.8	2600	125	27300	5.2
1320	1000	5000	0.9	2640	125	21425	5.2
1360	1250	6250	I.2	2680	125	27550	5.2
1400	2250	8500	1.6	2720	500	28050	5.3
1440	1000	9500	1.8	2760	125	28175	5.3
1480	1500	11000	2.1	2800	125	28300	5.4
1520	500	11500	2.2	2840	125	28425	5.4
1560	750	12250	2.3	2880	125	28550	5.4
1600	1125	13375	2.5	2920	125	28675	5.4
1640	800	14175	2.7	2960	125	28800	5.5
1680	750	14925	2.8	3000	125	28925	5.5
1720	400	15325	2.9	3040	125	29050	5.5
1760	750	16075	3.0	3080	125	29175	5.5
1800	1000	17075	3.2	3120	125	29300	5.5
1840	850	17925	3.4	3160	125	29425	5.6
1880	m l	1842.5	3.5	3200	250	29675	5.6
1920	750	19175	3.6	3240	250	29925	5.7
1960	1000	20175	3.8	3280	125	30050	5.7
2000	1000	21175	4.0	3320	125	30175	5.7
2040	500	21675	4.1	3360	375	30550	5.8
2080	500	22175	4.2	3400	375	30925	5.9
2120	750	22925	4.3	3440	250	31175	5.9
2160	600	23525	4.5	3480	300	31475	6.0
2200	400	23925	4.5	3520	300	31775	6.0
2240	500	24425	4.6	3560	300	32075	6.1
2280	500	24925	4.7	3600	375	32450	6.1
2320	750	25675	4.9				
2360	375	26050	4.9				
2400	500	26550	5.0				

Appendix C. Soils Database Description

Appendix C. Soils Database Description

The Soils data base reflects information described in the State Survey Report for the South Puget Sound Area (WDNR, 1974). The State Soil Mapping Units are based on an average of the most common soil properties, climate characteristics, topographic features, etc., found on the soil unit. The Soils data base provides information from the State Soil Survey Report regarding natural and disturbed stability characteristics of each mapping unit. However, the data base does not include all rating categories listed in the report. Included in the Soils database are the following parameters:

WRIA#:	Water Resource Inventory Area number.
Subwatershed:	Name of study watershed.
Quad:	Name of USGS 7 1/2 minute quadrangle.
Map symbol:	State soil symbol number, as shown on Soil overlay.
Acres:	Area, as measured on Soil overlay.
Soil name:	State soil name.
Index Spp:	Dominant tree species.
Site index:	Reflects a measurement of forest quality based on the most commonly observed tallest tree species, and it's average height within a certain age.
Depth:	Aver-age depth of mapping unit, in inches.
Drainage:	The natural drainage capacity of soils is determined by saturation frequency and duration during soil formation. Drainage capacity is defined by seven classes; excessively, somewhat excessively, well, moderately well, somewhat poorly, poorly, and very poorly drained. These classes describe the rate of water movement throughout the soil. Most of the soil mapping units in this study are either well or moderately well drained.
Nat Stab:	Natural slope stability refers to the undisturbed state of a slope under normal climatic circumstances. The natural slope is rated

as stable or unstable based on significant problems with soil properties, underlying material, drainage, and natural slope failures (e.g, landslides). If no significant problems in any of the above factors are present the slope is deemed as stable. An unstable slope rating will be assigned if any or some of the above stated problems are found to occur in a natural slope.

Dist Stab: Disturbed slope stability refers to slopes that have been impacted by human activities. These slopes are rated as stable if no significant stability problems arise as the result of road construction or timber harvesting. An unstable rating is based on the presence of slope related problems that can be overcome or minimized by applying current road construction technology and maintenance, or by implementing alternatives. Very unstable ratings are assigned to slope stability problems that cannot be entirely corrected by the application of current technology.

Rd Ero Haz: The ratings of cut, fill and sidecast hazards due to road construction are based on the areas soil properties, underlying material behavior, steepness of slope, soil drainage, and seasonal wetness. If the area is relatively level this rating does not apply. Slight ratings for road construction hazards can be overcome with standard road construction methods, and moderate hazard ratings can be reduced or minimized. Severe hazard ratings can only be reduced by special road construction methods.

TH Ero Haz: Timber harvest areas erosion potential is a result of water action. on surface soils. The soil properties, rainfall, storm intensity, and slope interactions of an area define the amount of erosion that takes place. A low rating is assigned to an area where potential surface erosion is minimal. Medium ratings indicate that erosion potential is significant and extensive erosion can occasionally occur; however, this can be reduced through careful logging practices. High ratings are given to areas where widespread surface erosion may frequently occur unless logging practices that minimize disturbances are applied.

Appendix D. Vegetation Database

Appendix D. Vegetation Database Description

The Vegetation overlay consists of numbered cells which delineate stand areas. Information pertaining to the vegetative characteristics of each of these cells is contained in the vegetation database for each watershed. Due to the large number of cells, each watershed has a separate database, but the formats of the databases are identical. The database contains the following information for each cell:

WRIA: Water Resource Inventory Area number

Sub: Study watershed name, where Ch = Charley and Ma = Mashel

Stand: Cell number, from the Vegetation overlay

Type: Primary land use, where

01 = residential/developed
02 = noncultivated pasture
03 = cultivated pasture
04 = gravel pit
05 = brush
06 = rock outcrop

10 = forest with no grazing
11 = forest with grazing
12 = powerline
13 = radio tower

20 = wetland
21 = stream corridor
22 = lake

Acres: Net acres of the cell, with ribbon acres (i.e., roads) subtracted out

YearOr: Year of origin

DomSpp: Dominant species, where

df = douglas fir
ra = red alder
tf = true fir
wh = western hemlock

cc = cedars
pr = planned regeneration

SubSpp: Subdominant species, blank if dominant greater than 80% by basal area

TPA: Trees per acre

Owner: Land owner, where
01 = Champion International Corporation
02 = Weyerhauser Company
03 = Washington Department of Natural Resources
04 = U.S. Forest Service
05 = Seaboard Lumber company
06 = Burlington Northern Corporation
07 = City of Tacoma
08 = Plum Creek Timber Company

Legal: Township, range, and section

ID: Identification number assigned by the landowner

Comments: "tpa is estimate" means that tpa was interpreted from stocking class codes, rather than a direct survey

"aerial photo inter-p" means that the information was determined through use of aerial photos and extrapolation of data from adjacent and similar stands

Tables D-1 and D-2 are a list of the stands, according to type and year of origin, for the upper Mashel River and Charley Creek watersheds, respectively.

Riparian Vegetation

The Riparian database contains information from the Vegetation overlay that pertains to the corridor of the mainstem of Charley Creek and the Mashel River. The database includes the following parameters:

WRIA:	Water Resource Inventory Area number
Subwatershed:	Study watershed name, where Ch = Charley and Ma = Mashel
Stand:	Number of the stand on vegetation overlay
Length:	Linear distance along stream corridor, in feet
Dom Spp:	Dominant species, where df = douglas-fir, wh = western hemlock, tf = true fir, and ra = red alder
Orig Year:	Year of origin

Tables D-3 and D-4 are listings from the Riparian database, sorted by year of origin, for the two study watersheds. Subtotals for each year of origin are in parentheses.

Table D-l. Mashel River - Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
Non-Forested Lands				
Gravel Pits				
4	44	0	2.5	16N06E08
4	45	0	1.0	16N06E08
4	341	0	1.5	16N06E29
4	342	0	1.5	16N06E29
4	347	0	4.0	16N06E29
4	348	0	1.0	16N06E29
4	431	0	1.5	16N06E33
4	so2	0	4.5	15N06E03
4	192	0	1.5	16N06E20
4	193	0	2.0	16N06E20
	Total Gravel Pits		21.0	
Brush and Open Areas				
5	64	0	1.5	16N06E15
5	65	0	3.0	16N06E15
	Total Brush and Open Areas		4.5	
Rock Outcrop				
6	100	0	2.5	16N06E17
6	158	0	15	16N06E19
6	162	0	2.0	16N06E19
6	163	0	2.0	16N06E19
6	164	0	1.5	16N06E19
6	191	0	1.0	16N06E20
6	323	0	5.0	16N06E28
	Total Rock Outcrop		15.5	
Wetlands				
2	2600	0	1.0	16N06E22
2	3030	0	8.0	16N06E27
2	4880	0	5.0	16N06E35
2	380	0	45	16N06E08
2	630	0	4.0	16N06E15
	Total Wetlands		22.5	

Type	Stand	Year of Origin	Acres	Legal
Streams				
2	2221	0	34.0	16N06E21
2	2291	0	4.5	16N06E22
2	4411	0	4.0	16N06E33
2	2581	0	4.0	16N06E22
		Total Streams	46.5	
Lakes				
2	2662	0	3.0	16N06E26
2	2612	0	5.0	16N06E26
		Total Lakes	8.0	
		Total Non-Forested Lands	118.0	
Forested Lands				
1930s Year of Origin				
10	521	1933	34.0	16N05E25
10	46	1934	4.0	16N06E08
10	76	1934	51.0	16N06E16
10	204	1934	8.0	16N06E21
10	254	1934	7.5	16N06E22
10	301	1934	4.0	16N06E27
10	315	1934	3.0	16N06E28
10	336	1934	62.0	16N06E29
10	350	1934	11.0	16N06E29
10	406	1934	49.0	16N06E32
10	442	1934	42.5	16N06E33
10	448	1934	7.5	16N06E33
10	531	1936	2.0	16N05E25
		Total 1930s	285.5	
1940s Year of Origin				
10	528	1944	11.0	16N05E25
10	546	1946	63.0	16N05E24
10	525	1947	13.0	16NOSE2.5
10	529	1947	22.3	16N05E25

Type	Sand	Year of Origin	Acres	Legal
10	526	1948	9.0	16N05E25
10	543	1949	49.0	16N05E24
10	555	1949	27.5	16N05E13
		Total 1940s	194.8	
1950s Year of Origin				
10	61	1950	12.0	16N06E15
10	62	1950	30.0	16N06E15
10	66	1950	39.0	16N06E16
10	70	1950	21.5	16N06E16
10	78	1950	58.0	16N06E16
10	82	1950	11.0	16N06E17
10	90	1950	2.0	16N06E17
10	201	1950	68.0	16N06E21
10	208	1950	31.0	16N06E21
10	210	1950	70.0	16N06E21
10	211	1950	23.5	16N06E21
10	212	1950	8.0	16N06E21
10	223	1950	2.0	16N06E21
10	227	1950	4.0	16N06E22
10	230	1950	27.0	16N06E22
10	231	1950	18.5	16N06E22
10	232	1950	25.0	16N06E22
10	238	1950	86.0	16N06E22
10	739	1950	525	16N06E22
10	240	1950	23.5	16N06E22
10	241	1950	16.5	16N06E22
10	244	1950	22.0	16N06E22
10	246	1950	14.0	16N06E22
10	256	1950	65	16N06E22
10	259	1950	4.0	16N06E22
10	272	1950	65	16N06E27
10	282	1950	103.0	16N06E27
10	287	1950	106.5	16N06E27
10	288	1950	8.5	16N06E27
10	290	1950	11.0	16N06E27
10	294	1950	11.5	16N06E27
10	295	1950	16.0	16NO6E.27
10	296	1950	145	16N06E27
10	298	1950	0.5	16N06E27
10	305	1950	11.0	16N06E28
10	306	1950	21.5	16N06E28
10	310	1950	61.5	16N06E28
10	311	1950	11.0	16N06E28
10	325	1950	1.0	16N06E28

Mashel River -Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
10	332	1950	14.5	16N06E29
10	423	1950	94.0	16N06E33
10	458	1950	20.5	16N06E34
10	462	1950	20.5	16N06E34
10	477	1950	0.5	16N06E34
10	511	1950	5.5	15N06E04
10	532	1950	4.0	16N05E25
10	536	1950	5.5	16N05E25
10	537	1950	7.8	16N05E25
10	538	1950	7.7	16N05E25
10	539	19%	20.0	16N05E24
10	533	1951.	54.6	16N05E25
10	530	1952	6.0	16N05E25
10	540	1952	18.6	16N05E24
10	542	1953	46.2	16N05E24
10	544	1953	13.3	16N05E24
10	545	1953	23.1	16N05E24
10	534	1954	14.0	16N05E25
10	562	1954	5.5	16N05E13
10	566	1954	53.7	16N05E13
10	554	19%	44.0	16N05E24
10	541	1956	82	16N05E24
10	553	1957	16.1	16N05E24
10	535	1958	45.6	16N05E25
10	549	1958	24.7	16N05E24
10	551	1958	7.1	16N05E24
10	558	1958	28.1	16N05E24
10	561	1959	38.8	16N05E13
		'Total 1950s	1709.4	
1960s Year of Origin				
10	25	1960	5.0	16N06E08
10	30	1960	85	16N06E08
10	34	1960	15.0	16N06E08
10	47	1960	8.5	16N06E08
10	52	1960	1.0	16N06E08
10	53	1960	10.5	16N06E08
10	54	1960	11.0	16N06E08
10	57	1960	8.0	16N06E09
10	58	1960	1.0	16N06E09
10	60	1960	3.0	16N06E15
10	68	1960	6.0	16N06E16
10	71	1960	1.0	16N06E16
10	72	1960	10.0	16N06E16
10	73	1960	10.0	16N06E16

Type	Stand	Year of Origin	Acres	Legal
10	75	1960	4.0	16N06E16
10	77	1960	69.0	16N06E16
10	79	1960	8.5	16N06E16
10	81	1960	24.5	16N06E17
10	83	1960	36.5	16N06E17
10	87	1960	5.0	16N06E17
10	83	1960	5.0	16N06E17
10	93	1960	35.0	16N06E17
10	94	1960	18.5	16N06E17
10	95	1960	39.0	16N06E17
10	98	1960	51.0	16N06E17
10	99	1960	24.5	16N06E17
10	111	1960	24.5	16N06E18
10	112	1960	9.0	16N06E18
10	11.3	1960	24.5	16N06E18
10	117	1960	1.0	16N06E18
10	118	1960	6.5	16N06E18
10	119	1960	1.0	16N06E18
10	121	1960	9.5	16N06E18
10	130	1960	4.5	16N06E18
10	133	1960	65	16N06E18
10	142	1960	6.0	16N06E19
10	143	1960	6.0	16N06E19
10	150	1960	34.0	16N06E19
10	154	1960	61.5	16N06E19
10	169	1960	12.5	16N06E20
10	177	1960	41.0	16N06E20
10	203	1960	7.5	16N06E21
10	205	1960	8.5	16N06E21
10	209	1960	13.5	16N06E21
10	213	1960	27.0	16N06E21
10	214	1960	77.5	16N06E21
10	219	1960	48.0	16N06E21
10	233	1960	16.0	16N06E22
10	234	1960	18.0	16N06E22
10	235	1960	24.0	16N06E22
10	236	1960	325	16N06E22
10	242	1960	28.5	16N06E22
10	243	1960	20.0	16N06E22
10	245	1960	12.0	16N06E22
10	247	1960	23.0	16N06E22
10	248	1960	21.5	16N06E22
10	250	1960	7.0	16N06E22
10	251	1960	14.5	16N06E22
10	252	1960	1.5	16N06E22
10	253	1960	19.5	16N06E22
10	255	1960	19.0	16N06E22
10	257	1960	10.0	16N06E22

Type	Stand	Year of Origin	Acres	Legal
10	271	1960	1.0	16N06E26
10	273	1960	31.0	16N06E27
10	274	1960	18.0	16N06E27
10	276	1960	13.5	16N06E27
10	281	1960	1.0	16N06E27
10	283	1960	30.0	16N06E27
10	284	1960	2.5	16N06E27
10	285	1960	2.8	16N06E27
10	286	1960	1.5	16N06E27
10	291	1960	1X.5	16N06E27
10	293	1960	24.5	16N06E27
10	297	1960	13.0	16N06E27
10	299	1960	13.0	16N06E27
10	300	1960	11.0	16N06E27
10	302	1960	11.0	16N06E27
10	304	1960	22.0	16N06E28
10	307	1960	66.0	16N06E28
10	308	1960	10.5	16N06E28
10	309	1960	5.0	16N06E28
10	313	1960	16.0	16N06E28
10	314	1960	29.5	16N06E28
10	37.6	1960	40.5	16N06E28
10	327	1960	1.5	16N06E28
10	333	1960	43.0	16N06E29
10	334	1960	8.5	16N06E29
10	335	1960	5.5	16N06E29
10	337	1960	14.0	16N06E29
10	338	1960	23.0	16N06E29
10	340	1960	24.0	16N06E29
10	351	1960	4.5	16N06E29
10	352	1960	2.5	16N06E29
10	353	1960	2.5	16N06E29
10	354	1960	1.5	16N06E29
10	3.55	1960	30.5	16N06E30
10	366	1960	7.0	16N06E30
10	367	1960	18.0	16N06E30
10	370	1960	104.0	16N06E30
10	371	1960	15.5	16N06E30
10	372	1960	19.5	16N06E30
10	374	1960	35.0	16N06E30
10	377	1960	11.5	16N06E30
10	378	1960	56.0	16N06E30
10	379	1960	24.0	16N06E30
10	380	1960	43.0	16N06E30
10	381	1960	30.0	16N06E30
10	382	1960	10.0	16N06E30
10	383	1960	16.5	16N06E30
10	384	1960	27.0	16N06E30

Type	Stand	Year of Origin	Acres	Legal
10	385	1960	75	16N06E30
10	386	1960	3.5	16N06E30
10	387	1960	3.0	16N06E30
10	389	1960	9.5	16N06E31
10	390	1960	11.0	16N06E31
10	392	1960	28.5	16N06E31
10	393	1960	17.5	16N06E31
10	394	1960	14.0	16N06E31
10	395	1960	31.0	16N06E31
10	396	1960	38.0	16N06E31
10	397	1960	25.0	16N06E31
10	398	1960	6.0	16N06E31
10	399	1960	17.0	16N06E31
10	400	1960	6.0	16N06E31
10	402	1960	1.0	16N06E32
10	403	1960	35.0	16N06E32
10	404	1960	10.5	16N06E32
10	405	1960	38.0	16N06E32
10	408	1960	20.0	16N06E32
10	409	1960	98.0	16N06E32
10	410	1960	7.5	16N06E32
10	411	1960	14.5	16N06E32
10	412	1960	30.5	16N06E32
10	413	1960	85	16N06E32
10	414	1960	7.0	16N06E32
10	415	1960	11.5	16N06E32
10	41.6	1960	28.5	16N06E32
10	418	1960	14.5	16N06E32
10	419	1960	3.0	16N06E32
10	421	1960	1.0	16N06E32
10	424	1960	13.5	16N06E33
10	427	1960	415	16N06E33
10	428	1960	20.0	16N06E33
10	429	1960	51.5	16N06E33
10	430	1960	7.5	16N06E33
10	434	1960	80.0	16N06E33
10	435	1960	21.0	16N06E33
10	436	1960	22.0	16N06E33
10	437	1960	18.5	16N06E33
10	438	1960	10.0	16N06E33
10	440	1960	34.0	16N06E33
10	445	1960	38.5	16N06E33
10	449	1960	6.0	16N06E33
10	454	1960	18.0	16N06E34
10	455	1960	10.5	16N06E34
10	457	1960	23.5	16N06E34
10	459	1960	7.5	16N06E34
10	460	1960	11.5	16N06E34

Type	Stand	Y car of Origin	Acres	Legal
10	461	1960	8.0	16N06E34
10	464	1960	51.0	16N06E34
10	465	1960	87.0	16N06E34
10	466	1960	8.5	16N06E34
10	467	1960	6.5	16N06E34
10	468	1960	8.0	16N06E34
10	470	1960	13.5	16N06E34
10	474	1960	9.0	16N06E34
10	475	1960	56.0	16N06E34
10	476	1960	26.5	16N06E34
10	499	1960	0.5	15N06E03
10	501	1960	2.5	15N06E03
10	504	1960	1.0	15N06E03
10	SOS	1960	12.0	15N06E03
10	506	1960	29.0	15N06E03
10	507	1960	7.5	15N06E03
10	508	1960	6.0	15N06E03
10	so9	1960	10.0	15N06E03
10	510	1960	26.5	15N06E04
10	513	1960	10.0	15N06E04
10	514	1960	59.0	15N06E04
10	518	1960	7.0	15N06E04
10	520	1960	7.0	15N06E04
10	547	1960	27.7	16N05E24
10	550	1960	7.2	16N05E24
10	557	1960	17.0	16N05E13
10	559	1960	10.0	16N05E13
10	560	1960	45.0	16N05E13
10	567	1960	10.0	16N05E13
10	573	1960	8.5	16N06E15
10	574	1960	35.0	16N06E23
10	575	1960	10.0	16N06E23
10	576	1960	8.5	16N06E26
10	490	1961	68.0	16N06E35
10	492	1961	3.0	16N06E35
10	571	1961	2.6	16N05E12
10	484	1962	5.0	16N06E35
10	485	1962	6.0	16N06E35
10	486	1962	87.0	16N06E35
10	491	1962	6.0	16N06E35
10	483	1963	32.0	16N06E35
10	487	1963	30.0	16N06E35
10	489	1963	21.0	16N06E35
10	568	1963	2.0	16N05E12
10	569	1963	8.0	16N05E12

Type	Stand	Year of Origin	Acres	Legal
10	572	1963	3.0	16N05E12
10	548	1968	5.4	16N05E24
		Total 1960s	3972.9	
1970s Year of Origin				
10	1	1970	17.0	16N06E06
10	3	1970	1.0	16N06E06
10	6	1970	29.0	16N06E07
10	10	1970	10.0	16N06E07
10	12	1970	2.0	16N06E07
10	15	1970	37.5	16N06E07
10	16	1970	28.0	16N06E07
10	17	1970	13.0	16N06E07
10	19	1970	16.0	16N06E07
10	20	1970	2.0	16N06E07
10	26	1970	40.5	16N06E08
10	27	1970	16.5	16N06E08
10	28	1970	11.0	16N06E08
10	29	1970	36.0	16N06E08
10	31	1970	19.0	16N06E08
10	32	1970	22.0	16N06E08
10	36	1970	15.0	16N06E08
10	37	1970	26.5	16N06E08
10	39	1970	16.5	16N06E08
10	41	1970	35.5	16N06E08
10	42	1970	8.0	16N06E08
10	43	1970	14.5	16N06J.m
10	51	1970	10.5	16N06E08
10	59	1970	1.0	16N06E09
10	67	1970	675	16N06E16
10	80	'1970	5.0	16N06E16
10	84	1970	14.0	16N06E17
10	85	1970	8.5	16N06E17
10	89	1970	6.5	16N06E17
10	92	1970	1.5	16N06E17
10	96	1970	315	16N06E17
10	97	1970	31.5	16N06E17
10	101	1970	42.5	16N06E17
10	102	1970	26.5	16N06E17
10	104	1970	2.0	16N06E17
10	105	1970	05	16N06E17
10	106	1970	3.5	16N06E17
10	109	1970	24.0	16N06E18
10	114	1970	1.0	16N06E18
10	115	1970	141.5	16N06E18

Type	Stand	Year of Origin	Acres	Legal
10	116	1970	22.0	16N06E18
10	120	1970	10.0	16N06E18
10	123	1970	17.0	16N06E18
10	125	1970	8.0	16N06E18
10	126	1970	10.0	16N06E18
10	129	1970	8.0	16N06E18
10	131	1970	17.0	16N06E18
10	132	1970	25.0	16N06E18
10	134	1970	7.5	16N06E18
10	135	1970	38.0	16N06E18
10	138	1970	4.0	16N06E18
10	140	1970	56.0	16N06E19
10	144	1970	16.0	16N06E19
10	145	1970	18.5	16N06E19
10	149	1970	10.0	16N06E19
10	152	1970	27.5	16N06E19
10	155	1970	9.5	16N06E19
10	159	1970	5.5	16N06E19
10	161	1970	13.0	16N06E19
10	165	1970	13.0	16N06E19
10	173	1970	23.0	16N06E20
10	178	1970	13.0	16N06E20
10	182	1970	32.0	16N06E20
10	188	1970	18.0	16N06E20
10	199	1970	3.0	16N06E20
10	207	1970	8.5	16N06E21
10	215	1970	59.0	16N06E21
10	216	1970	23.5	16N06E21
10	217	1970	12.0	16N06E21
10	218	1970	13.5	16N06E21
10	220	1970	9.5	16N06E21
10	224	1970	2.0	16N06E21
10	228	1970	2.5	16N06E22
10	237	1970	17.0	16N06E22
10	249	1970	8.5	16N06E22
10	264	1970	75	16N06E26
10	268	1970	4.0	16N06E26
10	275	1970	105	16N06E27
10	277	1970	105	16N06E27
10	279	1970	765	16N06E27
10	289	1970	5.5	16N06E27
10	312	1970	9.0	16N06E28
10	316	1970	37.9	16N06E28
10	319	1970	8.0	16N06E28
10	320	1970	555	16N06E28
10	321	1970	10.0	16N06E28
10	324	1970	1.0	16N06E28
10	328	1970	24.0	16N06E28

Type	Stand	Year of Origin	Acres	Legal
10	331	1970	12.0	16N06E28
10	339	1970	10.0	16N06E29
10	349	1970	29.0	16N06E29
10	355	1970	11.5	16N06E29
10	360	1970	8.0	16N06E29
10	361	1970	8.5	16N06E29
10	363	1970	8.0	16N06E29
10	375	1970	46.0	16N06E30
10	388	1970	22.0	16N06E30
10	391	1970	27.0	16N06E31
10	401	1970	1.0	16N06E32
10	417	1970	1.5	16N06E32
10	420	1970	5.0	16N06E32
10	422	1970	5.0	16N06E32
10	425	1970	5.0	16N06E33
10	426	1970	7.0	16N06E33
10	433	1970	8.5	16N06E33
10	439	1970	16.0	16N06E33
10	443	1970	15.0	16N06E33
10	444	1970	9.0	16N06E33
10	446	1970	8.5	16N06E33
10	447	1970	05	16N06E33
10	456	1970	0.5	16N06E34
10	463	1970	62.0	16N06E34
10	469	1970	20.5	16N06E34
10	471	1970	96.5	16N06E34
10	472	1970	6.5	16N06E34
10	473	1970	5.5	16N06E34
10	478	1970	11.5	16N06E34
10	479	1970	10.0	16N06E34
10	480	1970	3.5	16N06E34
10	482	1970	13.0	16N06E34
10	4%	1970	2.0	15N06E02
10	500	1970	44.5	15N06E03
10	503	1970	8.5	15N06E03
10	512	1970	6.0	15N06E04
10	515	1970	16.0	15N06E04
10	516	1970	2.0	15N06E04
10	517	1970	10.0	15N06E04
10	519	1970	225	15N06E04
10	521	1970	1.0	15N06E04
10	522	1970	7.0	15N06E04
10	524	1970	11.0	15N06E04
10	570	1970	213	16N05E12
10	552	1972	3.6	16N05E24
10	556	1974	17.0	16N05E13
10	14	1975	255	16N06E07
10	122	1975	30.5	16N06E18

Type	Stand	Year of Origin	Acres	Legal
10	x37	1975	76.0	16N06E18
10	168	1975	28.5	16N06E19
10	226	1975	19.0	16N06E21
10	292	1975	27.0	16N06E27
10	318	1975	84.5	16N06E28
10	329	1975	11.5	16N06E28
10	330	1975	23.5	16N06E28
10	357	1975	56.0	16N06E29
10	364	1975	7.5	16N06E29
10	432	1975	18.5	16N06E33
10	452	197s	7.5	16N06E33
10	453	1975	5.0	16N06E34
10	481	1975	7.5	16N06E34
10	523	1975	7.0	15N06E04
10	563	1975	30.0	16N05E13
10	564	1975	18.7	16N05E13
10	565	1975	17.1	16N05E13
		Total 1970s	2842.6	
1980s Year of Origin				
10	9		1.5	16N06E07
10	11	1980	159.5	16N06E07
10	13	1980	115	16N06E07
10	18	1980	9.0	16N06E07
10	22	1980	57.0	16N06E07
10	24	1980	0.5	16N06E07
10	33	1980	46.5	16N06E08
10	40	1980	17.5	16N06E08
10	48	1980	3.0	16N06E08
10	49	1980	9.5	16N06E08
10	50	1980	1.5	16N06E08
10	55	1980	26.0	16N06E08
10	56	1980	325	16N06E08
10	69	1980	1.5	16N06E16
10	74	1980	46.5	16N06E16
10	86	1980	132.5	16N06E17
10	91	1980	385	16N06E17
10	103	1980	8.5	16N06E17
10	107	1980	6.5	16N06E17
10	108	1980	7.0	16N06E18
10	1.10	1980	37.0	16N06E18
10	124	1980	4.0	16N06E18
10	127	1980	10.5	16N06E18
10	128	1980	22.0	16N06E18
10	136	1980	35	16N06E18

Type	Stand	Year of Origin	Acres	Legal
10	139	1980	7.0	16N06E18
10	141	1980	1.0	16N06E19
10	146	1980	21.0	16N06E19
10	147	1980	40.0	16N06E19
10	148	1980	72.5	16N06E19
10	1.51	1980	13.0	16N06E19
10	153	1980	51.5	16N06E19
10	156	1980	33.5	16N06E19
10	157	1980	59.5	16N06E19
10	160	1980	10.0	16N06E19
10	166	1980	6.0	16N06E19
10	167	1980	15.5	16N06E19
10	170	1980	20.5	16N06E20
10	1'71	1980	19.5	16N06E20
10	1.72	1980	14.5	16N06E20
10	174	1980	1.0	16N06E20
10	175	1980	43.5	16N06E20
10	176	1980	12.5	16N06E20
10	1.79	1980	37.0	16N06E20
10	180	1980	36.5	16N06E20
10	183	1980	83.0	16N06E20
10	184	1980	31.0	16N06E20
10	185	1980	26.0	16N06E20
10	186	1980	1.0	16N06E20
10	187	1980	9.5	16N06E20
10	189	1980	0.5	16N06E20
10	194	1980	17.5	16N06E20
10	195	1980	28.0	16N06E20
10	1%	1980	6.0	16N06E20
10	197	1980	155	16N06E20
10	198	1980	7.5	16N06E20
10	200	1980	105	16N06E20
10	202	1980	85	16N06E21
10	206	1980	5.0	16N06E21
10	221	1980	15.0	16N06E21
10	225	1980	6.0	16N06E21
10	261	1980	0.0	16N06E26
10	263	1980	44.5	16N06E26
10	265	1980	10.5	16N06E26
10	269	1980	16.5	16N06E26
10	270	1980	6.5	16N06E26
10	278	1980	8.5	16N06E27
10	280	1980	4.5	16N06E27
10	317	1980	36.1	16N06E28
10	322	1980	5.0	16N06E28
10	343	1980	138.0	16N06E29
10	345	1980	42.5	16N06E29
10	346	1980	41.5	16N06E29

Mashel River • Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
10	356	1980	13.0	16N06E29
10	358	1980	9.5	16N06E29
10	359	1980	13.0	16N06E29
10	368	1980	15.0	16N06E30
10	369	1980	195	16N06E30
10	373	1980	5.5	16N06E30
10	376	1980	2.0	16N06E30
10	407	1980	2.0	16N06E32
10	450	1980	19.0	16N06E33
10	493	1980	20.5	15N06E02
10	494	1980	19.0	15N06E02
10	495	1980	16.5	15N06E02
10	497	1980	28.5	15N06E03
10	498	1980	26.5	15N06E03
10	2	1985	4.0	16N06E06
10	4	1985	7.0	16N06E07
10	5	1985	23.0	16N06E07
10	7	1985	14.0	16N06E07
10	8	1985	48.5	16N06E07
10	21	1985	26.0	16N06E07
10	23	1985	7.5	16N06E07
10	35	1985	2.5	16N06E08
10	181	1985	27.0	16N06E20
10	190	1985	0.5	16N06E20
10	344	1985	1.0	16N06E29
10	362	1985	2.0	16N06E29
10	451	1985	2.0	16N06E33
		Total 1980s	2214.1	
1990s Year of Origin (1 stand)				
10	262	1990	22.0	16N06E26
		Total 1990s	22.0	
		Total Forested Land	11241.3	

Table D-2. Charley Creek - Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
Non-Forested Land				
Gravel Pits				
4	153		5.9	20N08E22
		Total Gravel Pits	5.9	
Powerlines				
12	125		4.0	20N08E21
12	161		17.0	20N08E21
		Total Powerlines	21.0	
Radio Tower				
13	190		1.5	20N08E21
		Total Radio Tower	1.5	
Wetlands				
20			1.0	20N08E08
		Total Wetlands	1.0	
Lakes				
22	151		4.8	20N08E22
22	180		2.0	20N08E17
22	189		1.0	20N08E21
22	200		2.0	20N08E10
22	201		1.0	20N08E10
72	64		1.4	20N08E09
		Total Lakes	12.2	
		Total Non-Forested Lands	41.6	

Charley Creek -Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
Forested Lands				
Pre-1900 Year of Orign				
10	163	1640	18.5	20N08E09
10	L58	1650	7.5	20N08E21
10	95	1850	79.3	20N08E07
10	192	1850	6.0	20N08E18
10	193	1850	10.0	20N08E18
10	34	1853	109.7	20N08E04
10	50	1861	10.5	20N08E10
10	92	1865	15.7	21N08E07
10	10	1865	6.7	20N08E04
10	120	1865	3.0	20N08E15
10	115	1866	38.6	20N08E15
10	67	1866	21.9	20N08E10
10	54	1866	6.0	20N08E10
10	66	1866	6.6	20N08E10
10	53	1866	11.4	20N08E10
10	65	1866	2x.4	20N08E10
10	58	1866	19.4	20N08E10
10	51	1866	31.8	20N08E10
10	59	1866	61.7	20N08E10
10	70	1866	123.2	20N08E09
10	174	1866	4.0	20N08E08
10	68	1870	3.8	20N08E09
10	36	1870	63	20N08E04
10	69	1870	6.7	20N08E09
10	62	1870	8.0	20N08E09
10	63	1870	18.1	20N08E09
10	61	1870	15.8	20N08E09
10	60	1870	15.3	20N08E09
10	37	1870	53.0	20N08E04
10	35	1870	59.3	20N08E04
10	129	1870	6.7	20N08E16
10	114	1872	59.6	20N08E16
10	99	1873	15.9	20N08E09
10	101	1873	104.4	20N08E09
10	'71	1878	59.2	20N08E09
10	32	1875	10.7	20N08E04
10	30	1875	9.6	20N08E04
10	29	1875	10.3	20N08E04
10	28	1875	10.0	20N08E04
10	13	1875	28.6	20N08E04
10	16	1875	24.4	20N08E04
10	25	1875	30.0	20N08E04
10	12	1875	60.3	20N08E04
10	169	1878	32.0	20N08E08

Charley Creek - Year of Origin Report

Type	Stand	Year of Origin	Acres	Legal
10	1.5	1876	6.5	20N08E04
10	24	1876	6.0	20N08E04
10	100	1880	7.9	20N08E09
10	162	1880	5.0	20N08E09
10	164	1880	199.0	20N08E09
10	182	1880	3.0	20N08E17
10	183	1880	4.0	20N08E17
10	184	1880	5.0	20N08E17
10	9	18882	13	21N08E33
10	91	1882	12.6	20N08E07
10	78	1882	14.9	20N08E05
10	33	1882	13.1	20N08E04
10	88	1882	184.2	20N08E04
10	77	1882	29.4	20N08E05
10	76	1882	20.1	20N08E05
10	72	1882	55.3	20N08E05
10	79	1882	355	20N08E06
10	73	1882	24.2	20N08E05
10	167	1882	5.5	20N08E08
10	168	1882.	3.0	20N08E08
10	23	1882	0.6	21N08E15
10	105	1885	28.7	20N08E16
10	111	1889	15.4	20N08E16
10	110	1889	4.9	20N08E16
10	113	1889	73	20N08E16
10	112	1889	39.8	20N08E16
10	108	1889	12.6	20N08E16
10	203	1889	16.4	20N08E16
10	98	1890	215	20N08E09
10	84	1893	22.7	20N08E06
		Total Pre-1900s	2073.3	
1900s Year of Origin				
10	107	1903	6.3	20N08E16
10	106	1903	58.8	20N08E16
10	109	19%	24.6	20N08E16
		Total 1900s	89.7	
1940s Year of Origin				
10	47	1947	2.2	20N08E10
10	1	1949	41.3	21N08E33

Type	Stand	Year of Origin	Acres	Legal
10	2	1949	111.7	21N08E33
10	7	1949	61.3	21N08E33
10	8	1949	30.2	21N08E33
10	22	1949	54.7	21N08E33
10	11	1949	41.4	20N08E04
10	176	1949	27.0	21N08E34
10	14	1949	9.8	20N08E04
		Total 1940s	379.6	
1950s Year of Origin				
10	43	1951	52.5	20N08E03
10	46	1951	15.0	20N08E03
10	42	1951	49.6	20N08E03
10	44	1951	55.0	20N08E03
10	20	1951	91.6	20N08E03
10	19	1951	1.3	20N08E03
10	45	1951	12.0	20N08E03
		Total 1950s	277.0	
1960s Year of Origin				
10	104		149.8	20N08E16
10	128	1960	7.8	20N08E16
10	97	1960	61.1	20N08E07
10	142	1960	32.7	20N08E12
10	145	1960	41.7	20N08E12
10	143	1960	23.0	20N08E12
10	147	1960	75.7	20N08E22
10	172	1960	88.0	20N08E08
10	179	1960	330.0	20N08E17
10	135	1960	67.0	20N08E18
10	198	1960	133.0	20N08E18
10	130	1960	5.0	20N08E16
10	144	1961	5.0	20N08E12
10	191	1965	57.0	20N08E18
10	202	1968	13.0	20N08E22
10	154	1968	50.0	20N08E22
		Total 1960s	1,139.8	

Type	Stand	Year of Origin	Acres	Legal
1970s Year of Origin				
10	123	1970	60.0	20N08E16
10	122	1570	32.3	20N08E16
10	148	1970	23.9	20N08E22
10	159	1970	8.1	20N08E21
10	171	1970	80.0	20N08E08
10	173	1970	270.0	20N08E08
10	178	1970	35.0	20N08E17
10	181	1970	235.0	20N08E17
10	186	1970	89.0	20N08E20
10	187	1970	17.0	20N08E20
10	188	1970	7.0	20N08E20
10	194	1970	65.0	20N08E18
10	1%	1970	7.0	20N08E18
10	197	1970	32.0	20N08E18
10	127	1970	8.0	20N08E16
10	3	1971	21.0	21N08E33
10	5	1971	11.8	21N08E34
10	149	1971	18.4	20N08E22
10	x75	1971	45.0	21N08E34
10	177	1971	14.0	21N08E34
10	40	1972	62.8	20N08E04
10	152	1972	12.0	20N08E22
10	150	1972	2.5	20N08E22
10	126	1973	3.0	20N08E21
10	57	1973	29.4	20N08E10
10	49	1973	190.5	20N08E10
10	17	1974.	3.9	20N08E04
10	18	1974	26.3	20N08E04
10	132	1974	57.0	20N08E21
10	155	1974	18.0	20N08E18
10	155	1974	76.2	20N08E21
10	156	1974	315	20N08E21
10	185	1974	149.0	20N08E20
10	141	1974	63.1	20N07E12
10	41	1975	9.2	20N08E03
10	39	1975	34.6	20N08E03
10	93	1975	172.5	20N08E07
10	121	1975	3.1	20N08E15
10	119	1975	34.0	20N08E15
10	124	1976	157.0	20N08E21
10	157	1976	6.1	20N08E21
10	160	1976	9.0	20N08E21
10	82	1977	12.7	20N08E06
10	134	1977	12.0	20N08E07
10	86	1978	69.2	20N08E06
10	48	1978	27.6	20N08E10

Type	Stand	Year of Origin	Acres	Legal
10	27	1978	132.9	20N08E04
10	136	1978	16.0	20N08E01
10	166	1978	119.0	20N08E06
10	13.5	1978	643.0	20N08E06
		Total 1970s	2679.6	
1980s **Year** of Origin				
10	117	1980	142.3	20N08E15
10	56	1980	266.5	20N08E10
10	31	1980	36.7	20N08E04
10	89	1980	69.4	20N08E07
10	90	1980	73.2	20N08E07
10	75	1980	46.1	20N08E05
10	137	1980	75.4	20N08E01
10	138	1980	12.0	20N08E01
10	139	1980	54.2	20N08E12
10	4	1982	7.3	21N08E34
10	87	1982	11.3	20N08E06
10	21	1982	11.2	20N08E03
10	118	1982	21.7	20N08E21
10	131	1982	69.7	20N08E21
10	38	1982	18.5	20N08E03
10	85	1982	62.2	20N08E06
10	165	1982	28.0	20N08E06
10	83	1983	2.3	20N08E05
10	6	1985	15.5	21N08E33
10	103	1985	60.4	20N08E16
10	74	1985	6.1	20N08E05
10	26	1985	43.0	20N08E05
10	102	1985	68.8	20N08E16
10	116	1987	32.2	20N08E16
10	55	1988	18.8	20N08E10
10	94	1988	105.3	20N08E07
10	146	1988	4.7	20N08E12
		Total 1980s	1,362.8	
1990s Year of Origin				
10	80	1990	20.7	20N08E07
10	52	1990	61.2	20N08E10
10	96	1990	9.3	20N08E07
10	133	1990	15.7	20N08E12

Type	Stand	Year of Origin	Acres	Legal
10	140	1990	20.5	20N08E12
10	81	1990	31.0	20N08E07
		Total 1990s	158.4	
		Total Forested Acres	8160.2	
		Total Stand Acres	8201.8	

Table D-3. Mashel River Riparian Vegetation Age

WRIA#	Subwater-shed	Stand Number	Length (feet)	Dominant Species	Year of Origin
11	Ma	527	400	df	1933
11	Ma	527	200 (600)	df	1933
11	Ma	254	1,000	wh	1934
11	Ma	301	200 (1,200)	wh	1934
11	Ma	528	500	wh	1944
11	Ma	528	400 (900)	wh	1944
11	Ma	529	400	df	1947
11	Ma	529	250	df	1947
11	Ma	52.5	200 (850)	wh	1947
11	Ma	222	7,500	ra	1950
11	Ma	282	2,050	wh	1950
11	Ma	282	400 (9,950)	wh	1950
11	Ma	533	250 (250)	df	1951
11	Ma	534	650 (650)	df	1954
11	Ma	154	2,700	wh	1960
11	Ma	150	1,750	wh	1960
11	Ma	1.43	1,500	ra	1960
11	Ma	119	2,200	ra	1960
11	Ma	255	500	wh	1960
11	Ma	283	1,000	wh	1960
11	Ma	283	1,000	wh	1960
11	Ma	297	500 (11,150)	wh	1960

WRIA#	Subwater-shed	Stand Number	Length (feet)	Dominant Species	Year of Origin
11	Ma	388	850	wh	1970
11	Ma	375	1,650	wh	1970
11	Ma	165	450	wh	1970
11	Ma	116	750	wh	1970
11	Ma	101	2,600	wh	1970
11	Ma	106	500	wh	1970
11	Ma	188	700	wh	1970
11	Ma	277	1,000	tf	1970
			(8,500)		
11	Ma	160	175	wh	1980
11	Ma	103	600	df	1980
11	Ma	194	700	df	1980
11	Ma	172	1,000	wh	1980
11	Ma	196	500	wh	1980
11	Ma	221	900	wh	1980
11	Ma	263	600	df	1980
11	Ma	261	400	tf	1980
11	Ma	265	500	tf	1980
			(5,375)		

Total Length 39,425

Table D-4. Charley Creek Age of Riparian Vegetation

WRIA#	Subwater-shed	Stand Number	Length (feet)	Dominant Species	Year of Origin
9	Ch	70	500 (500)	df	1866
9	Ch	36	1,250	df	1870
9	Ch	35	1,500	df	1870
9	Ch	68	2,000 (4,750)	df	1870
9	Cb	71	2,750 (2,750)	df	1875
9	Ch	88	1,800	wh	1882
9	Ch	88	2,050 (3,850)	wh	1882
9	Ch	176	2,050 (2,050)	ra	1949
9	Ch	20	2,550 (2,550)	wh	1951
9	Ch	173	1,375 (1,375)	wh	1960
9	Ch	172	1,375	wh	1970
9	Ch	173	1,500 (2,875)	wh	1970
9	Ch	3	1,000 (1,000)	df	1971
9	Ch	141	1,000 (1,000)	tf	1974
9	Ch	93	1,175	tf	1975
9	Ch	93	1,450 (2,625)	tf	1975

WRIA#	Subwater-shed	Stand Number	Length (feet)	Dominant Species	Year of Origin
9	Ch	139	2,250	tf	1980
9	Ch	137	2,400	tf	1980
			(4,650)		
9	Ch	38	500	df	1982
			(500)		
9	Ch	94	1,175	tf	1988
			(1,175)		
		Total Length	31,650		

Appendix E. Miscellaneous Features

Appendix E. Miscellaneous Features

The Miscellaneous Features database and overlay contain information on features found within the watersheds that were not described in the other databases. These features include the gaging station on Charley Creek and landslides in the upper Mashel River watershed. The following parameters are included in the database:

WRIA:	Water Resource Inventory Area number
Subwatershed:	Study area watershed
Cell:	Number shown on the Miscellaneous Features overlay
Name:	Type of feature
Acres:	Area of feature, as measured on map
Orig_Year:	Year of origin
Status:	Active, static, or healing condition; a qualitative observation
Info_source:	Source of information: field verified or interpreted from aerial photos, etc.
Comments 1,2,3:	Additional comments describing the feature

The following is a list of the miscellaneous features and some of the descriptive parameters included in the database.

Miscellaneous Features

Cell#	Name	Year of Origin	Status	Acres
4	Debris Flow	1989-90, winter	Static	15
6	Debris Flow	Post 1982	Static	5
1	Debris Flow	Post 1982, pre 1989	Static	18
		Total acres in debris flow		38
2	Sidecast Failure:	Pre 1965	Active	4
5	Sidecast Failure	Pre 1982, Post 1965	Healing	3
7	Sidecast Failure	Pre 1982, Post 1965	Active	10
8	Sidecast Failure	Post 1982, Pre 1989	Active	1
9	Sidecast Failure	Post 1982, Pre 1989	Active	1
10	Sidecast Failure	Pre 1982	Healing	1
3	Sidecast Failure	f'ost 1965, Pre 1982	Healing	2
		Total acres in sidecast failure		22